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**Development and transfer of technologies and implementation of the Technology Mechanism**
**Third synthesis report on technology needs identified by Parties not included in Annex I to the Convention**

# Third synthesis report on technology needs identified by Parties not included in Annex I to the Convention

## Note by the secretariat

*Summary*

This report synthesizes the information contained in the technology needs assessment (TNA) reports of 31 Parties not included in Annex I to the Convention. It highlights the technology needs of those Parties to mitigate greenhouse gas emissions and facilitate adaptation to the adverse impacts of climate change. One of the key findings arising from this report is that the TNAs conducted by Parties led to the development of national technology action plans (TAPs) that recommend enabling frameworks to address identified barriers to the development and transfer of prioritized technologies. Those TAPs and, additionally, the project ideas prepared by Parties facilitated the identification of technology transfer projects. The Subsidiary Body for Scientific and Technological Advice may wish to consider the information contained in this report and determine any further steps to support enhanced action on the development and transfer of technology.

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# I. Executive summary

## A. Introduction

1. This report synthesizes the information contained in the technology needs assessment (TNA) reports prepared by 31 Parties not included in Annex I to the Convention (non-Annex I Parties) in response to a request made by the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its thirty-fifth session.[1]

2. Those 31 Parties participated in the global TNA project, which had the objective of providing targeted financial and technical support to assist developing country Parties in developing or updating their TNAs and in preparing their technology action plans (TAPs). The project was supported by the Global Environment Facility (GEF) under the Poznan strategic programme on technology transfer and implemented by the United Nations Environment Programme (UNEP) in collaboration with the UNEP Risoe Centre.

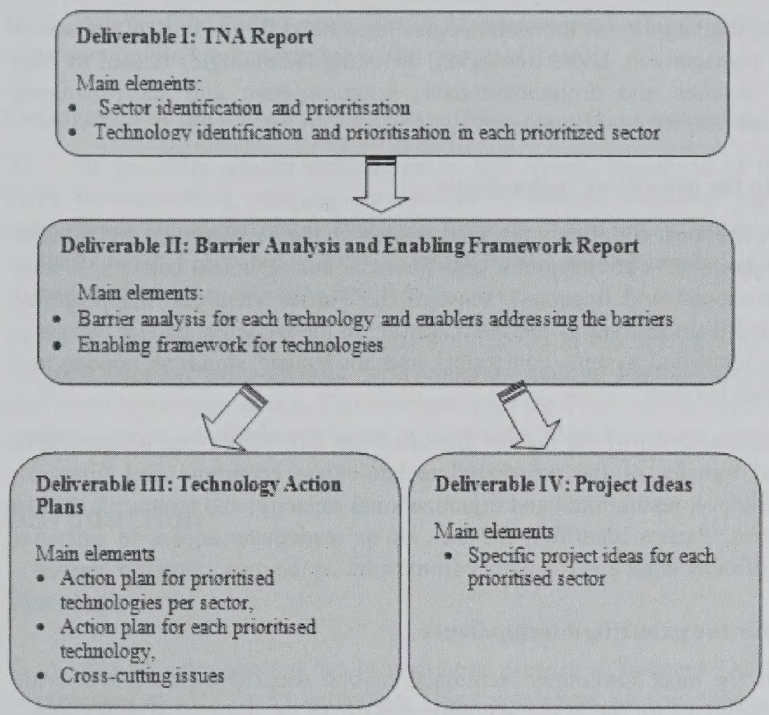
3. Almost all of the Parties prepared detailed TNA reports covering the full TNA process as suggested in the guidance provided by UNEP and in the *Handbook for Conducting Technology Needs Assessments for Climate Change* (hereinafter referred to as the TNA handbook)[2] prepared by the United Nations Development Programme (UNDP) (see figure 1). The TNA reports often included separate reports for each step of the TNA process, including TNA, barrier analysis and enabling framework, TAP and project ideas reports.

[1] FCCC/SBSTA/2011/5, paragraph 32.

[2] United Nations Development Programme. 2010. *Handbook for Conducting Technology Needs Assessments for Climate Change*. Available at <http://tech-action.org/Guidebooks/TNA_Handbook_Nov2010.pdf>.

Figure 1

**Proposed main Party deliverables from the technology needs assessment project**




*Source*: United Nations Environment Programme Risoe Centre.

## B. Key findings arising from the third synthesis report on technology needs

### 1. Process related

4. Of the 31 Parties that participated in the global TNA project, 29 prepared TNA reports on mitigation and all of them prepared TNA reports on adaptation.

5. Most of the Parties reported that the coordination of the TNA process was carried out by their ministry of environment. All 31 Parties mentioned involving stakeholders in the TNA process, particularly through workshops and expert consultation. However, only a few of the Parties reported involving stakeholders from the finance community.

6. Most of the Parties stated their national development priorities as a starting point for the TNA process.

### 2. Prioritized sectors

7. For mitigation, almost all of the Parties prioritized the energy sector. The most prioritized subsectors of the energy sector were energy industries and transport.

8. For adaptation, the agriculture and water sectors were the most prioritized.

### 3. Prioritized technologies for mitigation and adaptation

9. For mitigation, the majority of the technologies prioritized for the energy industries subsector were related to electricity generation. Solar photovoltaic and biomass/biogas

electricity generation technologies were the most prioritized technologies, followed by efficient lighting, waste to energy, wind turbines and hydropower.

10. For adaptation, the majority of the technologies prioritized for the agriculture sector were related to crop management. Biotechnologies, including technologies related to crop improvement, new varieties and drought-resistant, salient-tolerant and short-maturing varieties, were the most prioritized technologies.

## 4. Identified barriers to the prioritized technologies

11. For mitigation, the most commonly reported barriers to the development and transfer of the prioritized technologies were economic and financial and technical barriers. Within the first category (economic and financial), most of the Parties identified inappropriate financial incentives and disincentives as the main barrier. In the technical barrier category, many of the Parties identified system constraints and inadequate standards, codes and certification as the main barriers.

12. For adaptation, almost all of the Parties identified the following types of barriers to the development and transfer of the prioritized technologies: economic and financial; policy, legal and regulatory; institutional and organizational capacity; and technical. Within the first two categories, Parties identified the lack of or inadequate access to financial resources and an insufficient legal and regulatory framework as the most common barriers.

## 5. Identified enablers for the prioritized technologies

13. For mitigation, the most commonly mentioned enabler was the measure to provide or expand financial incentives for the implementation and use of the prioritized technology.

14. For adaptation, the most commonly mentioned enabler was the measure to increase the financial resources available for the technology, by introducing or increasing the allocation for the technology in the national budget or by identifying and creating financial schemes, funds, mechanisms or policies.

## 6. Technology action plans and project ideas

15. Almost all of the Parties developed TAPs, which consist of a group of measures to address the identified barriers to a prioritized technology. The total accumulative estimated budget of Parties for the implementation of their TAPs was USD 5.2 billion for mitigation and USD 2.4 billion for adaptation. However, the size of Parties' budgets varied significantly.

16. Almost all of the Parties developed project ideas as part of their TNA processes. In the context of their TNAs, Parties envisaged project ideas as concrete actions for the implementation of a prioritized technology. The total accumulative estimated budget of Parties for the implementation of their projects was USD 12.5 billion for mitigation and USD 12.2 billion for adaptation. However, as for the TAPs, the size of the individual budgets varied significantly between Parties.

## 7. Linkages between technology needs assessments and other processes

17. Most of the Parties reported that they did not consider the TNA process to be a stand-alone process. Rather, TNAs were often considered to complement national policies and plans for mitigating greenhouse gas (GHG) emissions and adapting to climate change.

18. Over half of the Parties elaborated on possible interlinkages between TNAs and other processes under and outside of the Convention. Many of those Parties noted that their TNAs drew on completed nationally appropriate mitigation actions (NAMAs) and national adaptation programmes of action (NAPAs), or identified the outputs of their TNAs as

inputs to the work on their national communications, NAMAs or national adaptation plans (NAPs).

19. A few of the Parties made clear references to the Technology Mechanism in relation to supporting the implementation of the results of TNAs.

### 8. Comparison of the second and third synthesis reports on technology needs

20. In the TNA reports synthesized in this report, almost all of the Parties included TAPs recommending enabling frameworks to address identified barriers to prioritized technologies. This is a major evolution from the TNA reports synthesized in the second synthesis report,[3] prepared in 2009, in which Parties only elaborated on the identification of possible next steps to address identified barriers.

21. In addition, in the TNA reports synthesized in this report, almost all of the Parties included detailed project ideas with concrete actions for the implementation of their prioritized technology needs. This contrasts with the TNA reports synthesized in the second synthesis report, in which only some of the Parties identified more generic project ideas.

# II. Introduction

## A. Mandate

22. SBSTA 35 requested the secretariat to prepare an updated TNA synthesis report to be presented at SBSTA 37, including TNAs conducted by non-Annex I Parties under the Poznan strategic programme on technology transfer.[4] By 31 July 2013 a total of 31 TNA reports were available and the information contained in them was synthesized in this report for consideration by SBSTA 39.

## B. Scope of the note

23. This report compiles and synthesizes the information contained in the TNA reports of 31 non-Annex I Parties that participated in the global TNA project and had submitted finalized TNA reports to the UNEP Risoe Centre by 31 July 2013.

## C. Possible action by the Subsidiary Body for Scientific and Technological Advice

24. The SBSTA may wish to consider the information contained in this report and:

(a) To provide further guidance to Parties relating to TNAs;

(b) To provide further guidance to the Technology Executive Committee and the secretariat on their further work, in collaboration with UNEP, to support the work of the Parties relating to TNAs;

(c) To determine any further steps to support enhanced action on the development and transfer of technology, including by facilitating the implementation of the results of the TNAs.

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[3] FCCC/SBSTA/2009/INF.1.

[4] FCCC/SBSTA/2011/5, paragraph 32. In the light of the small number of new TNA reports available in the lead-up to SBSTA 37, the preparation of the synthesis report was postponed until a representative number of TNA reports became available.

## D. Background

25. The global TNA project was supported by the GEF under the Poznan strategic programme on technology transfer and implemented by UNEP in collaboration with the UNEP Risoe Centre. It had the objective of providing targeted financial and technical support to assist 36 non-Annex I Parties in developing or updating their TNAs and in preparing their TAPs. As part of that support, in 2010 UNDP prepared an updated version of the TNA handbook, as referred to in paragraph 3 above, which provided methodological guidance to the Parties undertaking or updating their TNAs and TAPs.

26. In preparing their TNAs, Parties were encouraged to follow the guidance contained in that TNA handbook and in related guidebooks and tools prepared by UNDP, UNEP and the UNEP Risoe Centre.[5] A methodological structure for preparing a national TNA, as per the UNDP, UNEP and UNEP Risoe Centre guidance, is shown in figure 1. To be consistent with the guidance provided, the findings contained in this report are presented following a similar structure.

## E. General information

27. This report covers the finalized TNA reports of 31 non-Annex I Parties that were submitted to UNEP Risoe Centre by 31 July 2013 (see annex I for a list of those Parties and also figure 2). The regional distribution of those Parties is as follows:

(a) Africa: 10 Parties;

(b) Asia-Pacific: 10 Parties;

(c) Eastern Europe: three Parties;

(d) Latin America and Caribbean: eight Parties.

28. This report covers 28 developing country Parties (including nine least developed countries and three small island developing States) and three Parties with economies in transition to a market economy.

29. A total of 19 Parties submitted their reports in English, eight Parties in Spanish and four in French. Of the 31 Parties that participated in the global TNA project, 29 prepared TNA reports on mitigation and all of them prepared TNA reports on adaptation (see annex I).

30. Almost all of the Parties prepared detailed TNA reports covering the full TNA process as suggested in the guidance provided by UNEP and in the TNA handbook. The TNA reports often included separate reports for each step of the TNA process, including TNA, barrier analysis and enabling framework, TAP and project idea reports.

[5] See <tech-action.org/guidebooks.asp>.

Figure 2

**Geographical illustration of the Parties whose technology needs assessment reports are covered by the third synthesis report on technology needs**

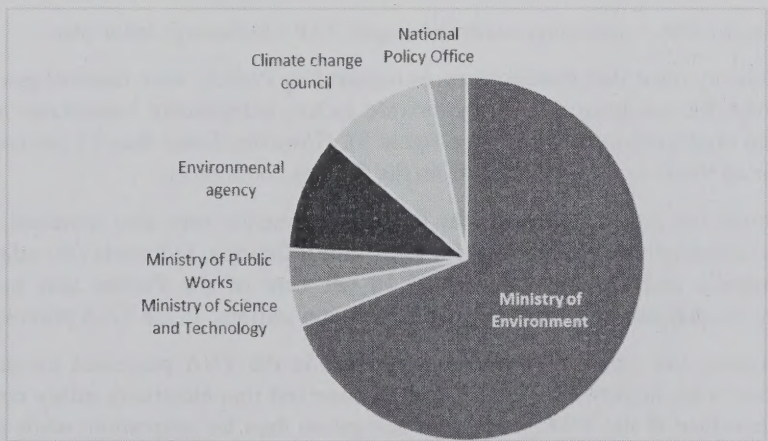
# III. The technology needs assessment process and national circumstances

## A. Organization of the technology needs assessment process and involvement of stakeholders

31. Most of the Parties (77 per cent) reported that the coordination of the TNA process was carried out by a national ministry (e.g. the ministry of environment) or a department within a ministry (see figure 3). For some of the Parties, the TNA process was coordinated by an independent government agency responsible for the environment (11 per cent). For other Parties, an inter-ministerial committee or council responsible for climate change issues undertook the management of the TNA process (11 per cent).

Figure 3

**Entities responsible for coordinating the organization of Parties' technology needs assessment processes**

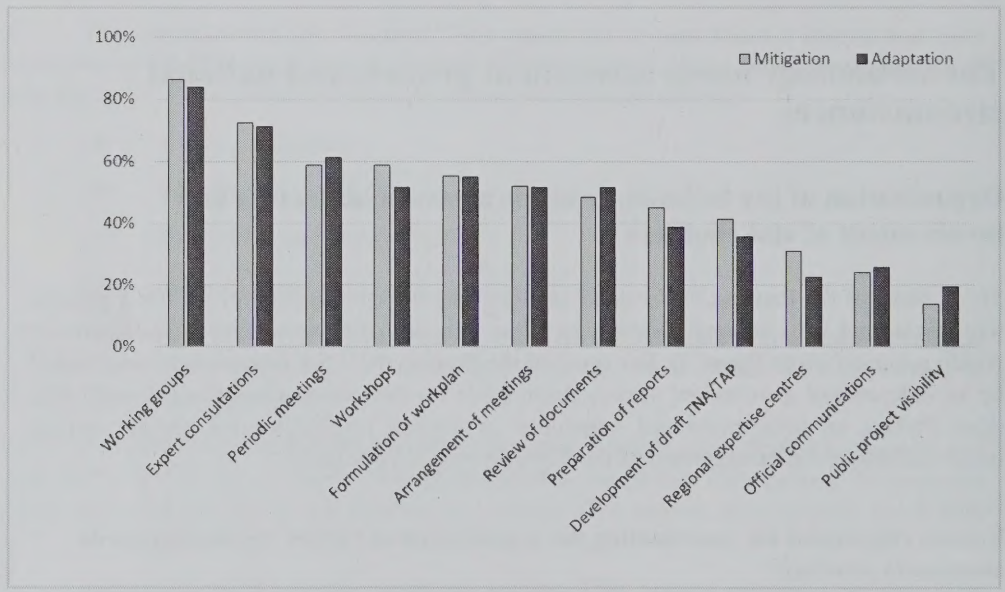


32. In terms of decision-making, almost all of the Parties (95 per cent) reported that a national steering committee was established as the decision-making body of the TNA, providing final endorsement of the results.

33. The TNA processes were consistently reported as being participatory, with all Parties mentioning stakeholder involvement. In most cases, Parties reported that stakeholders were involved in a consultative workshop at the beginning of the TNA process. Several of the Parties reported that this was followed by additional workshops organized to conduct the different steps in the TNA process.

34. As illustrated in figure 4, commonly used methods in the stakeholder involvement process included the creation of working groups, the consultation of external experts, the organization of periodic meetings and workshops and the joint formulation of a workplan. Some of the Parties mentioned that stakeholders were involved through small working group discussions, followed by consultation via the Internet with a wide range of stakeholders.

Figure 4
**Stakeholder involvement in the technology needs assessment process (percentage of Parties)**




*Abbreviations*: TNA = technology needs assessment, TAP = technology action plan.

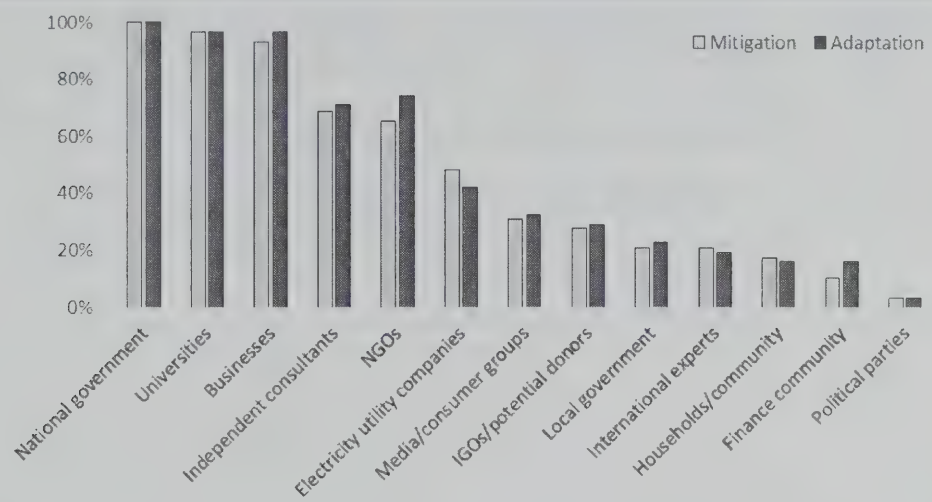
35. Commonly identified stakeholders, as reported by Parties, were national government representatives, the academic sector, the private sector, independent consultants and non-governmental organizations (NGOs) (see figure 5). However, fewer than 15 per cent of the Parties reported involving stakeholders from the finance community.

36. Some of the Parties reported that local governments were also involved, notably those of the capital cities of Cambodia (for mitigation), Georgia, Indonesia (for adaptation), Kenya, Mongolia and Zambia. A total of 10 per cent of the Parties also mentioned involving the media, such as newspapers and television stations, in the TNA process.

37. In general, the types of stakeholder involved in the TNA processes for mitigation and adaptation were largely the same. It can be observed that electricity utility companies were more involved in the TNA process for mitigation than for adaptation, while potential donor organizations, the finance community and NGOs were more involved for adaptation.

Figure 5

**Stakeholders involved in the technology needs assessment process (percentage of Parties)**




*Abbreviations*: NGO = non-governmental organization, IGO = intergovernmental organization.

38. Most of the Parties reported that stakeholder groups were involved in several stages of the TNA process and many provided detailed information on how stakeholders were involved in the specific steps in the TNA process. The majority of the Parties also reported using one common pool of stakeholders in relation to both adaptation and mitigation. Other Parties (23 per cent) grouped stakeholders according to their involvement in either mitigation or adaptation, or reported that they engaged different stakeholders for each sector prioritized and analysed (16 per cent).

39. Parties reported that stakeholders were primarily involved in the initial review of the background information for the TNA (such as the identification of national development priorities), the selection of key sectors and the prioritization of technologies. Stakeholders were less involved in assessing development priorities, formulating TAPs and developing project proposals. Box 1 illustrates how several of the Parties arranged stakeholder participation for their TNAs.

Box 1

**Examples of stakeholder participation in the technology needs assessment process as described in Parties' technology needs assessment reports**

| | |
|---|---|
| **Azerbaijan** | Stakeholders were identified as experts from ministries, agencies, businesses and non-governmental organizations (NGOs) and, for mitigation, also from one local village government. They were involved in the identification of national development priorities, the prioritization of sectors and the prioritization of technologies. |
| **Bangladesh** | Stakeholders were identified and divided into sectoral or thematic teams. Most of the stakeholders were representatives of ministries and universities. Stakeholder consultation took place at various stages of the technology needs assessment process. |
| **Indonesia** | Stakeholders were specifically identified for the energy and agriculture, forestry and other land-use sectors (mitigation) and for the water and infrastructure and settlements (including coastal zones) sectors (adaptation). They focused on discussing technical matters, such as compiling and pre-screening technologies, proposing criteria for the prioritization of technologies and rating technologies using those criteria. |
| **Kenya** | A very wide range of stakeholders were involved. Roles included participating in identifying sectors and technologies at an inception workshop and later in the prioritization of those elements. During a final workshop, the stakeholders also participated in an initial analysis of barriers. |
| **Mongolia** | Workshop discussions took place with stakeholders, including representatives of NGOs, universities and labour unions. The stakeholders provided input to the prioritization of sectors and technologies and the analysis of barriers. In order to reach a wider audience, key interviews took place with representatives of farmers and herders. |

## B. National circumstances

40. Consistent with the guidance provided in the TNA handbook, all of the Parties commenced their TNA reports with sections which identified: (a) their national circumstances with regard to the mitigation of GHG emissions and adaptation to climate change; and (b) their national development priorities, including existing policies and measures. Those two sections were then used as a basis for the prioritization of sectors for the TNA.

41. With regard to national circumstances related to the mitigation of GHG emissions, the majority of the Parties reported on their national GHG emission profile. Most of the Parties (62 per cent) reported that the majority of their national GHG emissions occurred in the energy sector (including energy industries and transport). Other Parties (20 per cent) reported that their highest level of GHG emissions was in the area of agriculture, while some of the Parties (11 per cent) reported their highest level of GHG emissions in the area of land use, land-use change and forestry (LULUCF) (see table 1 for Party-specific examples of key GHG-emitting sectors).

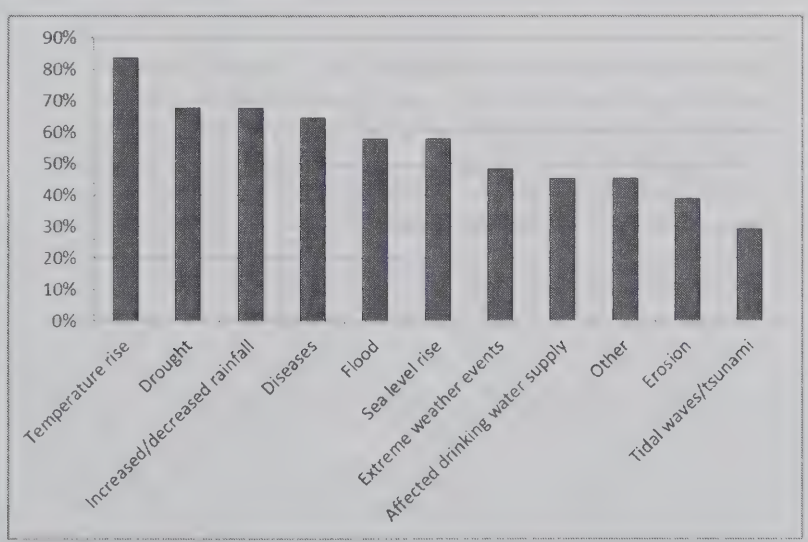
Table 1
**Examples of key greenhouse gas emitting sectors or areas as reported in Parties' technology needs assessment reports**

| *Party* | *Key emitting sector or area ($CO_2$eq)* | *Year* |
|---|---|---|
| Azerbaijan | Energy (41 Mt) | 2005 |
| Bhutan | Agriculture (1 Mt) | 2000 |
| Cambodia | Agriculture (21 Mt) | 2000 |
| Costa Rica | Energy (6 Mt) | 2005 |
| Dominican Republic | Energy (18 Mt) | 2009 |
| Mali | Land use, land-use change and forestry (20 Mt) | 2011 |
| Mauritius | Energy (2 Mt) | 2010 |
| Mongolia | Energy (10 Mt) | 2006 |

42. In the TNA reports for adaptation, all of the Parties included a reference to the potential national vulnerability of the country to climate change. Most of the Parties noted that their country was vulnerable to effects caused by temperature rise (mentioned by 84 per cent of the Parties), drought (68 per cent), increased or decreased rainfall (68 per cent), emerging diseases (65 per cent) and flood risk or sea level rise (both 58 per cent). In addition, some of the Parties (25 per cent) illustrated their potential vulnerability by referring to previous natural disasters within their borders (see figure 6 for a breakdown of commonly identified climate change impacts).

43. Most of the Parties referred to existing or ongoing national processes as sources of information on their national vulnerability to climate change. A total of 55 per cent of the Parties made a reference to, or extracted information from, their national communications. A total of 25 per cent of the Parties referred to their NAPAs, while one Party undertook a specific vulnerability assessment for its TNA.

Figure 6
**Commonly identified climate change impacts as reported in Parties' technology needs assessments (percentage of Parties)**



## C. National development priorities and existing policies and measures

44. Having identified their principal GHG-emitting sectors and national vulnerability to climate change, 81 per cent of the Parties clearly stated their national development priorities to be considered in the TNA process. Most of those Parties categorized their national development priorities as environmental, social or economic.

45. Commonly identified environmental development priorities were environmentally sustainable development (42 per cent of the Parties), efficient water management (39 per cent), the reduction of environmental risks (39 per cent) and reduced air pollution (35 per cent). Some other Parties, such as Bangladesh and Indonesia, put emphasis on the protection of coastal areas, while Azerbaijan and the Sudan highlighted the environmental priority of combating desertification.

46. Among the most often identified social development priorities were reducing poverty and creating wealth (55 per cent) and ensuring food security (35 per cent). Other common social priorities were improving infrastructure and services in rural areas, improving health conditions and improving education.

47. Economic development priorities commonly identified by Parties were the development of infrastructure and enhanced energy security (both mentioned by 48 per cent of the Parties). Other commonly identified economic priorities included improving employment and enhancing general economic growth, as well as developing tourism and reducing energy imports.

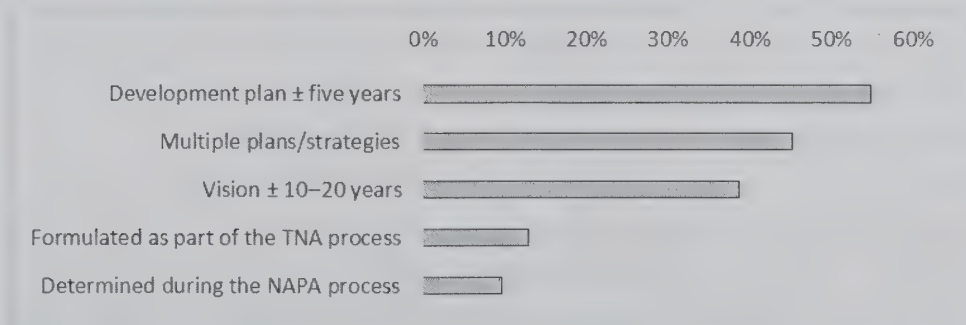
48. In addition to the above-mentioned environmental, social and economic development priorities, a number of the Parties mentioned other development priorities in their TNA reports. For example, some of the Parties reported that they wanted to be "part of the solution to global climate change" (see box 2 for examples of Party-specific development priorities).

Box 2
**Examples of national development priorities reported by Parties in their technology needs assessment reports**

| | *Environmental* | *Social* | *Economic* |
|---|---|---|---|
| **Indonesia** | • Coastal area protection<br>• Efficient water management | • Energy access for the poor<br>• Food security<br>• Poverty reduction<br>• Rural development | • Energy security<br>• Competitiveness |
| **Morocco** | • Sustainable use of resources | • Energy access for the poor<br>• Food security<br>• Poverty reduction<br>• Sustainable human development<br>• Rural development | • Energy security<br>• Infrastructure development<br>• Integration of multilateral trading<br>• Development of small and medium-sized enterprises |
| **Republic of Moldova** | • Reduced soil degradation<br>• Efficient water management | • Poverty reduction<br>• Rural education | • Energy security<br>• Employment<br>• Infrastructure development<br>• Disaster management<br>• Stable agricultural system |

49. In most cases, the national development priorities were derived from existing plans or measures, often short-, medium- or long-term development plans or visions (see figure 7). Some of the Parties based their development priorities on other processes or strategies, such as determining national development priorities for the TNA process in a participatory manner with stakeholders. Other Parties used priorities that had been determined during the NAPA process.

Figure 7
**Sources of the national development priorities identified by Parties in their technology needs assessment reports (percentage of Parties)**




*Abbreviations*: TNA = technology needs assessment, NAPA = national adaptation programme of action.

50. Related to their national development priorities, around half of the Parties referred to existing policies and measures (at both the national and the subnational level) for mitigation and adaptation to climate change. Some of those national programmes focused solely on

climate change, while others focused on climate change as part of an overall development plan or strategy. Examples of such programmes are presented in box 3.

51. Common national policies and measures mentioned included low-emission development plans, national green growth strategies, national environmental protection strategies, national climate change strategies (adaptation or mitigation), climate-resilient strategies, climate change response measures and climate change scenario documents. Some of the Parties also reported on the development of their NAPAs as background documents for TNAs for adaptation.

52. In addition to national climate change policy documents, Parties referred to existing policies and measures at the sectoral level. In most cases they were reported as having been prepared for the energy (76 per cent of the Parties) and agriculture, forestry and other land-use (33 per cent) sectors for mitigation and the agriculture (71 per cent) and water (68 per cent) sectors for adaptation.

53. Such sectoral policies and measures addressed, for instance, the following aspects:

(a) Energy sector: the share of renewable energy sources in the national grid, energy-efficiency improvements or rural electrification;

(b) Agriculture, forestry and other land-use sector (mitigation) and agriculture sector (adaptation): actions to combat land degradation, rules and regulations for seeds, renewable natural resources, agricultural modernization and natural resource management, combating desertification and food security;

(c) Water sector: improved water management techniques.

Box 3

**Examples of existing national policies and measures for mitigation and adaptation as reported in Parties' technology needs assessment reports**

| | |
|---|---|
| **Bangladesh** | Bangladesh Climate Change Strategy and Action Plan 2009 |
| **Cambodia** | National Strategic Development Plan Update 2009–2013 |
| **Cuba** | Integral Cuban Plan to Confront Climate Change |
| **Ghana** | National Climate Change Policy Framework; Ghana Shared Growth and Development Agenda; National Climate Change Adaptation Strategy |
| **Indonesia** | National Long-Term Development Plan 2005–2025 (Law no. 17, issued 2007); Indonesia Responses to Climate Change |
| **Mauritius** | Long-Term Energy Strategy 2009–2025 |
| **Republic of Moldova** | Low-Emission Development Strategy 2020 |
| **Rwanda** | National Green Growth and Climate-Resilient Strategy |
| **Sri Lanka** | National Energy Policy and Strategies |
| **Sudan** | 25-Year Strategy 2007–2033 |
| **Thailand** | National Strategic Plan on Climate Change Management 2008–2012 |
| **Viet Nam** | Climate change scenarios; Viet Nam Sustainable Development Vision; 2003 National Strategy for Environmental Protection until 2010 and Vision toward 2020 |
| **Zambia** | General policy on environment 2007 |

# IV. Prioritized sectors and technologies

## A. Methods and criteria for prioritizing sectors

54. In the previous chapters, it was shown how Parties identified their primary GHG-emitting sectors, potential national vulnerability to climate change and national development priorities in their TNAs. Having completed those steps, the majority of the Parties, consistent with the guidance provided by UNEP, then undertook the process of prioritizing certain sectors (and, for mitigation, subsectors)[6] in which national technology needs could be identified and analysed.

55. For mitigation, most of the Parties prioritized sectors and subsectors taking into consideration the GHG emissions from the primary national sectors and the national development priorities of the country. These often included consideration of in which sectors the largest combined GHG emission reductions and environmental, social and economic benefits could be achieved in the short, medium and long terms. For adaptation, the majority of the Parties prioritized adaptation sectors taking into consideration the sectors' vulnerability reduction potential and their national development priorities.[7]

56. Some other Parties prioritized sectors that had been chosen in earlier strategies. Additionally, other Parties introduced a new set of criteria for sector prioritization or prioritized sectors on the basis of open forum discussions.

## B. Sectors prioritized for mitigation

57. For mitigation, the energy sector was clearly the most prioritized sector, prioritized by 90 per cent of the Parties. Within the energy sector, the most prioritized subsectors were energy industries (82 per cent of the Parties) and transport (41 per cent).

58. The agriculture, forestry and other land-use sector was prioritized by approximately one third of the Parties. Of those Parties, 70 per cent prioritized the land subsector (including LULUCF). Other mitigation sectors and subsectors prioritized by Parties are shown in figures 8 and 9.[8]

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[6] The classification of mitigation sectors and subsectors in this report is based on the Intergovernmental Panel on Climate Change (IPCC) *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (overview, p.6), available at <http:// http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/0_Overview/V0_1_Overview.pdf>. The classification of adaptation sectors in this report is based on the IPCC *Climate Change 2007: Synthesis Report* (p.57), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf>. Where Parties have used their own classification, the sector information has been made comparable with the IPCC classification.

[7] It should be noted that Parties generally prioritized more than one sector: most of the Parties prioritized two or three sectors for each of mitigation and adaptation.

[8] See annex II for diagrams illustrating the sectors prioritized by each Party.

Figure 8

**Prioritized sectors for mitigation as reported in Parties' technology needs assessment reports (percentage of Parties)**

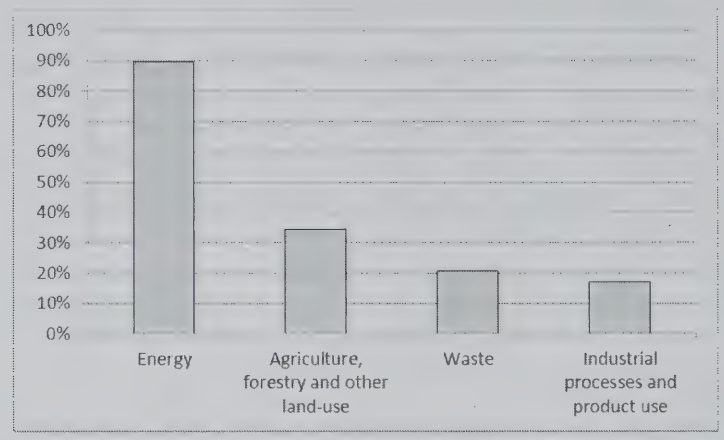
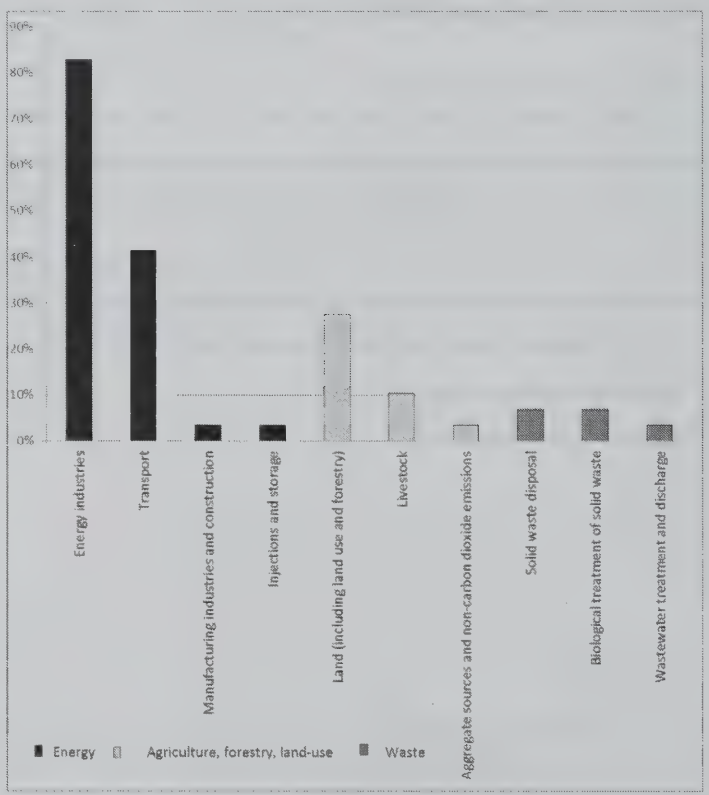



Figure 9

**Prioritized subsectors for mitigation as reported in Parties' technology needs assessment reports (percentage of Parties)**[a]




[a] Most of the Parties that prioritized the industrial processes and product-use sector did not prioritize subsectors for that sector (see also figure 8).

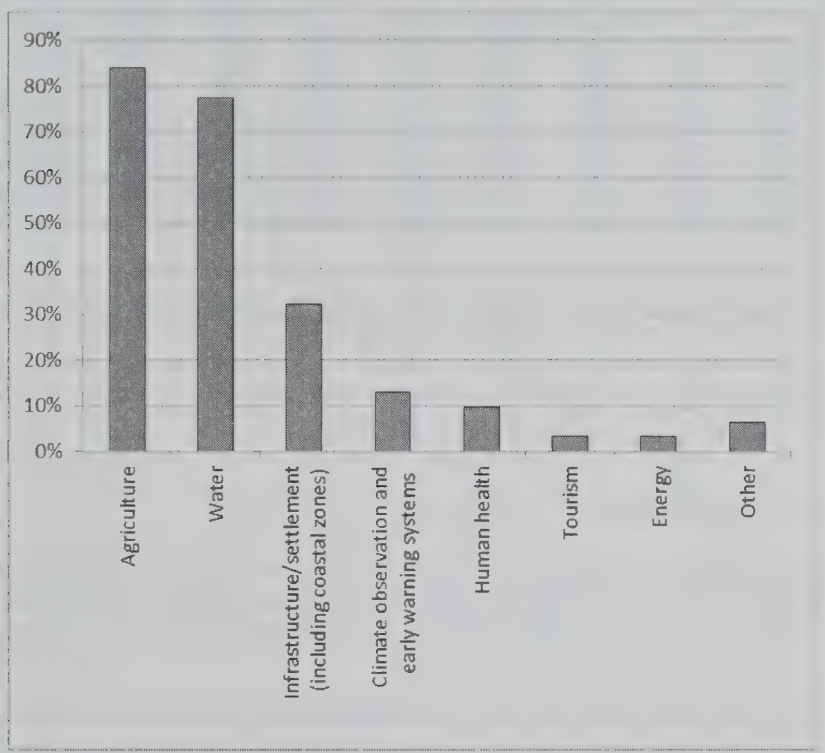
59. It may be observed that the sectors or subsectors prioritized by Parties are generally the sectors with the highest GHG emission levels nationally. A similar relationship can be observed between Parties' development priorities and the sectors prioritized by them for mitigation.

## C. Sectors prioritized for adaptation

60. For adaptation, the most commonly prioritized sectors were agriculture (84 per cent of the Parties), water resources (77 per cent) and infrastructure and settlements (including coastal zones) (32 per cent).[9] Figure 10 illustrates the sectors that were prioritized by Parties for adaptation.[10]

Figure 10

**Prioritized sectors for adaptation as reported in Parties' technology needs assessment reports (percentage of Parties)**




## D. Methods and criteria for prioritizing technologies

61. Following the prioritization of sectors for their TNAs, all of the Parties then prioritized technologies in those sectors, thus identifying their most important national technology needs.

[9] Two Parties prioritized the biodiversity sector. As that is not a sector consistent with the IPCC classification, it has been categorized under "other" in figure 10.

[10] It should be noted that the IPCC does not classify subsectors for adaptation. Therefore, this report, remaining consistent with the IPCC classification, does not identify adaptation subsectors. In addition, it may be noted that Parties did not generally prioritize subsectors for adaptation in their TNAs.

62. For many of the Parties, an initial step in the process of prioritizing technologies was the creation of preliminary lists of technology options for the prioritized sectors. That preliminary selection was based largely on the results of stakeholder consultations and expert analysis and often took into consideration a variety of factors depending on national circumstances.[11]

63. Parties then prioritized certain technologies from that preliminary list on the basis of specific criteria. For prioritizing mitigation technologies, most of the Parties applied social (97 per cent of the Parties that undertook mitigation TNAs), economic (86 per cent) and environmental (79 per cent) criteria, as well as the potential of the technology to reduce GHG emissions (97 per cent), its market potential (72 per cent), its employment generation potential (55 per cent) and its investment and operational costs (55 and 52 per cent, respectively).

64. For prioritizing adaptation technologies, Parties applied social (90 per cent of the Parties), environmental (90 per cent) and economic (81 per cent) criteria, as well as the potential contribution of the technology to the reduction of the national vulnerability to climate change (94 per cent) and the technology's investment and operational costs (65 and 42 per cent, respectively).

65. Having defined criteria for prioritizing technologies in their prioritized sectors, most of the Parties used a multi-criteria decision analysis (MCDA) to rank their technology needs for mitigation and adaptation. Some of the Parties first assessed the benefits of their technology options (using an MCDA) and then extended that to a cost–benefit analysis by evaluating the benefits alongside the costs of the options.

## E. Technologies prioritized for mitigation

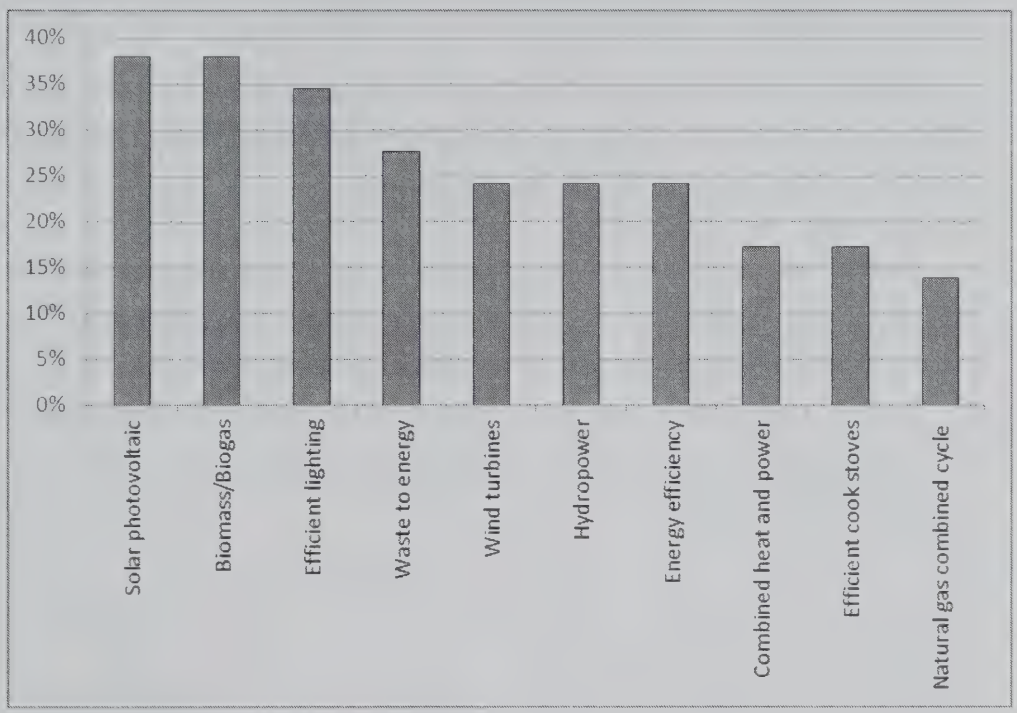
66. For mitigation, Parties identified a total of more than 300 different technology options in their preliminary lists (or long lists) of technologies within their prioritized mitigation sectors or subsectors. More than 120 different technologies were prioritized by Parties.

67. Within the energy sector (the most prioritized mitigation sector), the majority of the technologies prioritized for the energy industries subsector were related to electricity generation. Solar photovoltaic and biomass/biogas electricity generation technologies were the most prioritized technologies, prioritized by almost 40 per cent of the Parties that undertook mitigation TNAs (see figure 11).

[11] Lists of globally available technologies, such as those contained in annex 7 to the TNA handbook, the sectoral guidebooks prepared by the UNEP Risoe Centre and the online technology database <Climatetechwiki.org>, were often used as starting points for preparing long lists of technology options.

Figure 11

**Prioritized technologies for the energy industries subsector as reported in Parties' technology needs assessment reports (percentage of the Parties that undertook mitigation technology needs assessments)**




68. As many of the prioritized technologies in the energy industries subsector were renewable energy technologies, box 4 illustrates some Party-specific examples of prioritized renewable energy technologies in that subsector.

Box 4

**Examples of renewable energy technologies for electricity generation prioritized by Parties in their technology needs assessments**

| | |
|---|---|
| **Azerbaijan** | Wind turbines, solar thermal (concentrated solar power), solar photovoltaic (single-axis flat plate) and small-scale hydro |
| **Côte d'Ivoire** | Microcogeneration systems for heat and power, biomass combined heat and power, green gas production (purified biogas), solar photovoltaic and solar photovoltaic pumps |
| **Cuba** | Biomass combined heat and power, hydroelectricity, biogas from anaerobic digestion and biomass gasification |
| **Lebanon** | Wind turbines, solar photovoltaic (single-axis flat plate) and small-scale hydro |
| **Rwanda** | Wind turbines, biomass combined heat and power, green gas production (purified biogas), solar thermal (concentrated solar power), solar photovoltaic, small-scale hydro and pumped storage hydraulic turbines |
| **Senegal** | Wind turbines, green gas (biomass gas) production and solar photovoltaic (single-axis flat plate) |

69. In terms of scale of application, approximately 20 per cent of the total number of prioritized technologies for electricity generation were small-scale technologies (i.e. home application or, in more general terms, not grid-connected). Another approximately 20 per cent of the technologies within that category would be applied on a large scale (i.e. grid-connected plants). The remaining technologies were classified as applicable on a small or large scale, depending on the national context.

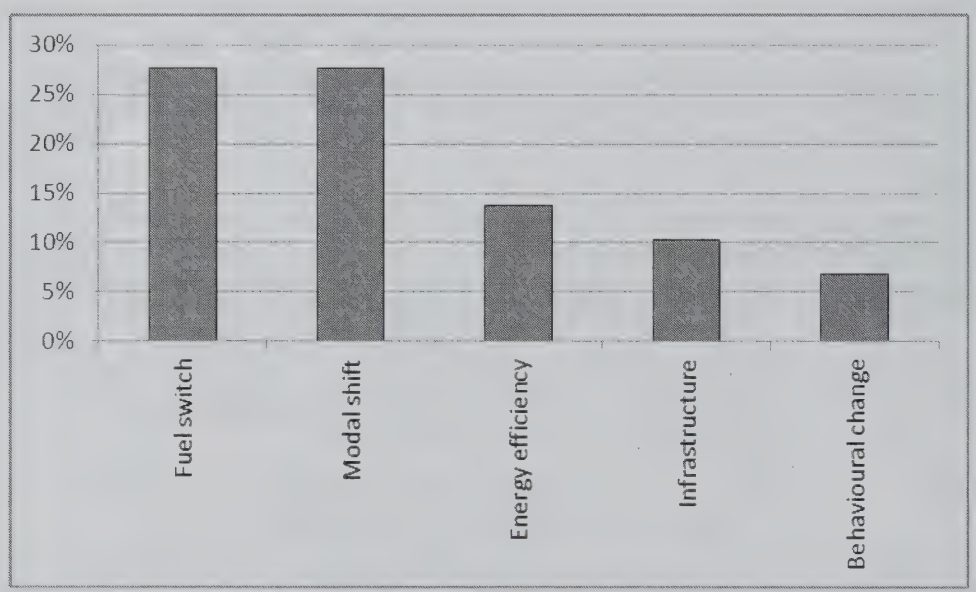
70. Around two thirds of the total number of prioritized technologies for electricity generation could be applicable in the short term. The remaining technologies are estimated to be applicable in the medium to longer term, as they are either at the research, development and demonstration stage of development or in the process of deployment in the market.[12]

71. For the transport subsector of the energy sector, over 25 per cent of the Parties prioritized technologies relating to fuel switching, such as electric or liquefied natural gas vehicles, and modal shifts, such as mass rapid transit road or rail systems. Figure 12 illustrates the most commonly prioritized technologies for the transport subsector.

72. It may be observed from the overview of prioritized technologies for transport that Parties mostly prioritized soft technologies, aimed at achieving behavioural change in relation to transportation and the improvement of infrastructure, both of which can be applied in the relatively short term.

Figure 12

**Prioritized technology categories in the transport subsector as reported in Parties' technology needs assessment reports (percentage of the Parties that undertook mitigation technology needs assessments)**




73. For the agriculture, forestry and other land-use sector, prioritized technologies for mitigation in the forestry subsector were quite diverse, with technologies prioritized across a wide range of categories. Such categories included sink enhancement (afforestation or reforestation) and forest rehabilitation and restoration techniques. Prioritized technologies

[12] This assessment of technology availability in time is based on the classification of technologies in annex 7 to the TNA handbook, the TNA technology guidebooks and <Climatetechwiki.org> and does not take into consideration country-specific circumstances and needs.

included optimal forest plantation, incentives to reduce deforestation and the promotion of sustainable community forest management.

74. Technologies prioritized for the agriculture subsector of the agriculture, forestry and other land-use sector included: bagasse combined heat and power; nutrient management and improvement; organic farming; classic, mini or no tillage; fertilizer dosing; and irrigation techniques.

## F. Technologies prioritized for adaptation

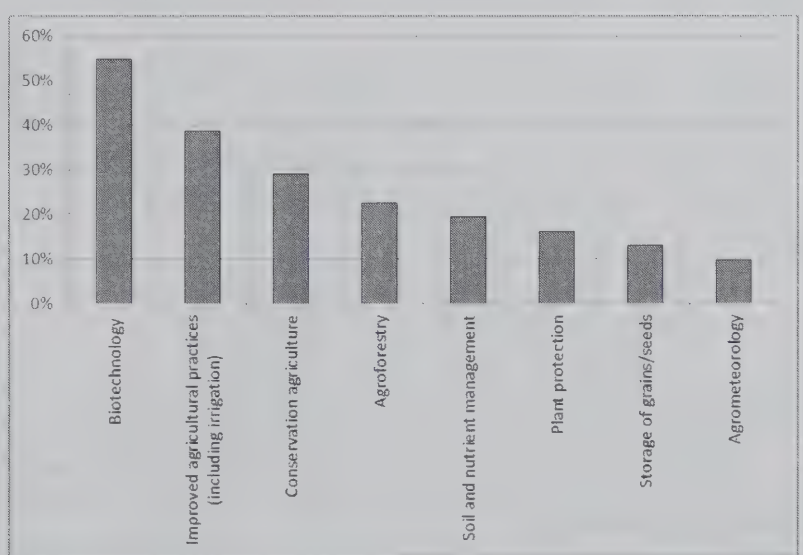
75. For adaptation, Parties identified a total of more than 320 different technology options in their preliminary lists (or long lists) of technologies within their prioritized adaptation sectors. More than 150 different technologies were prioritized by Parties.

76. The technology needs identified in relation to adaptation comprised hard technologies, such as dikes and floodwalls, community irrigation systems and salinity-tolerant rice varieties, and soft technologies, such as the organization of water user associations and knowledge transfer.

77. Some of the Parties also prioritized indigenous technologies that could be applied to assist national adaptation to changing weather conditions, such as traditional designs for housing, bunds, levees, dikes and mangrove plantations. For those technologies, the technology needs were generally related to the deployment and diffusion of the technologies and the further improvement of their design and quality through research and development.

78. Within the agriculture sector (the most prioritized adaptation sector), the majority of the technologies prioritized were related to crop management. Biotechnologies, including technologies related to crop improvement, new varieties and drought-resistant, salient-tolerant and short-maturing varieties, were the most prioritized technologies, prioritized by more than 50 per cent of the Parties. Figure 13 shows the most commonly prioritized technologies for the agriculture sector.

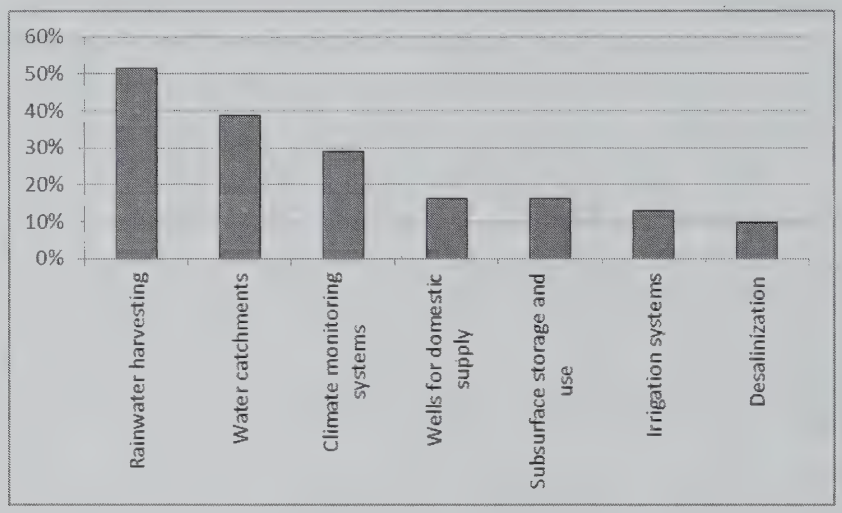
Figure 13
**Prioritized technologies in the agriculture sector as reported in Parties' technology needs assessment reports (percentage of Parties)**



79. In the water sector, Parties prioritized technologies relating to rainwater harvesting (more than 50 per cent of the Parties) and water catchments (almost 40 per cent). Figure 14 illustrates the most commonly prioritized technologies in the water sector.

80. It may be noted that 93 per cent of the total number of water technologies prioritized can be categorized as supply-side measures, with the remaining 7 per cent relating to demand-side measures.

Figure 14
**Prioritized technologies in the water sector as reported in Parties' technology needs assessment reports (percentage of Parties)**




81. Within the infrastructure and settlements (including coastal zones) sector, most of the prioritized technologies were related to coastal protection, including both hard and soft measures. The most often prioritized technology was wetland restoration, with other prioritized technologies including seawalls, community-based early warning systems for natural disaster prevention and beach reclamation.

# V. Identified barriers to and enablers for technologies

82. Following the prioritization of technologies, most of the Parties identified and analysed technology-specific barriers to the development, deployment, transfer and diffusion (hereinafter referred to as the development and transfer) of their prioritized technologies and identified possible measures required to overcome such barriers.[13]

83. To assist in the identification of barriers and enablers, many of the Parties further categorized the technologies as:

(a) Consumer goods (e.g. compact fluorescent lamps or rice);

(b) Capital goods (e.g. investment in an energy plant);

[13] When assessing potential barriers to prioritized technologies within their prioritized sectors, most of the Parties followed the guidelines contained in the 2012 UNEP guidebook *Overcoming Barriers to the Transfer and Diffusion of Climate Technologies*. Consistent with that guidance, the majority of the barriers identified by Parties correspond, in terms of barrier classification, to those contained in annex A to that handbook (p.77), available at <http://tech-action.org/Guidebooks/TNA_Guidebook_OvercomingBarriersTechTransfer.pdf>. Many of the Parties also added other country-specific barriers that reflected their national circumstances.

(c) Public goods (e.g. water supply and safe water infrastructure);

(d) Non-market goods (e.g. modal shift in transport).

84. On the basis of that categorization, many of the Parties identified barriers and enablers using tools such as logical problem analysis, problem trees and market mapping. It was found that most of the prioritized technologies for mitigation were capital and public goods, while for adaptation most of the prioritized technologies fell in the categories of consumer and public goods.

85. In general, Parties identified specific potential barriers to the development and transfer of each of their prioritized technologies. Across all of their prioritized technologies, it was found that most of the Parties selected at least one barrier within each barrier category as classified in the UNEP guidebook *Overcoming Barriers to the Transfer and Diffusion of Climate Technologies* (hereinafter referred to as the UNEP guidebook).

86. The structured approach taken by Parties in identifying sectors, technologies and specific barriers to their respective priority technologies, in combination with different national circumstances, led Parties to identify very specific measures to overcome those barriers. Thus, the sections of this report that synthesize information on enablers focus on the most commonly identified measures. Several of the Parties mentioned that some of the measures proposed were already in place at the local or subnational level but are still to be extended to the national level.

## A. Barriers to and enablers for mitigation technologies

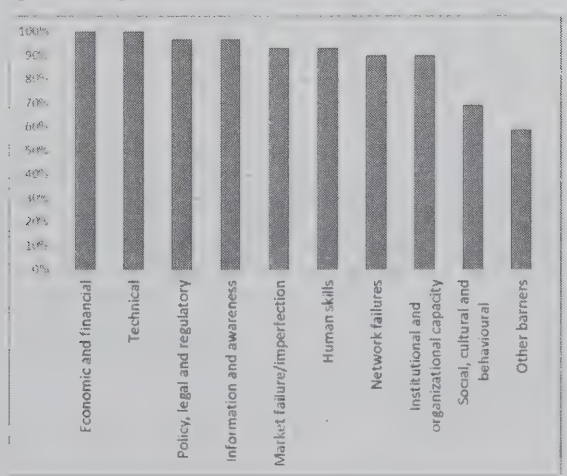
### 1. Barriers

87. Overall, irrespective of the sector, all of the Parties identified economic and financial and technical barriers as barriers to the development and transfer of prioritized technologies for mitigation (see figure 15).

88. Within the category of economic and financial barriers, most of the Parties (90 per cent) identified inappropriate financial incentives and disincentives as the main barrier, irrespective of the sector or technology. In the technical barrier category, many of the Parties (69 per cent) identified system constraints and inadequate standards, codes and certification as the main barriers.

Figure 15

**Overview of barriers to technologies for mitigation identified in Parties' technology needs assessments (percentage of Parties)**



### 2. Enablers

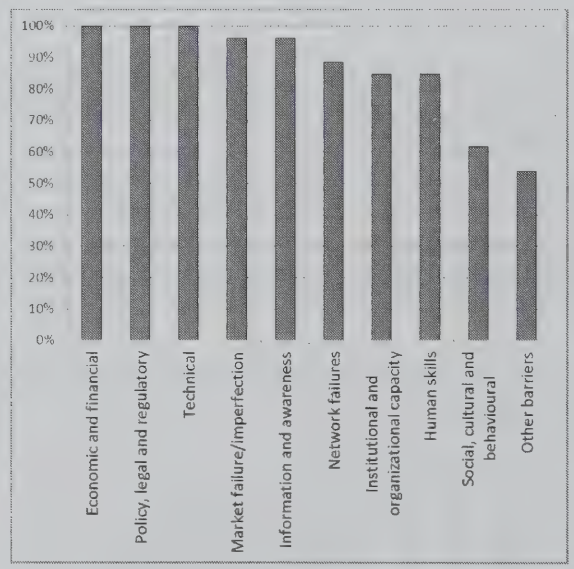
89. For mitigation, the most commonly mentioned enabler on a cross-sectoral basis was the measure to provide or expand financial incentives for the implementation and use of the prioritized technology. Another commonly mentioned measure was the formulation or updating of regulations, policies and standards related to the technology. Other commonly mentioned enablers on a cross-sectorial basis were the provision of capacity-building and the establishment of information and awareness programmes to promote and develop capacity with regard to the specific technology.

## B. Mitigation: barriers and enablers identified for the energy sector

### 1. Barriers

90. All of the Parties that prioritized technologies in the energy sector (the most prioritized mitigation sector) identified the following types of barriers to the development and transfer of those technologies: economic and financial; policy, legal and regulatory; and technical. The majority of the Parties also mentioned barriers related to market failure or imperfection (96 per cent), information and awareness (96 per cent) and network failures (88 per cent) (see figure 16).

Figure 16
**Overview of barriers to the development and transfer of mitigation technologies within the energy sector identified in Parties' technology needs assessments (percentage of Parties)**




91. For the energy sector, the most commonly reported economic and financial barriers were the lack of or inadequate access to financial resources and inappropriate financial incentives and disincentives (85 per cent of the Parties). Within the policy, legal and regulatory barrier category, all of the Parties noted that an insufficient legal and regulatory framework was the main barrier. Other commonly reported barriers for those two categories are presented in figures 17 and 18. In the technical barrier category, system constraints (65 per cent of the Parties) and inadequate standards, codes and certification (62 per cent) were the two most commonly identified barriers.

Figure 17

**Economic and financial barriers to the development and transfer of mitigation technologies within the energy sector identified in Parties' technology needs assessments (percentage of Parties)**

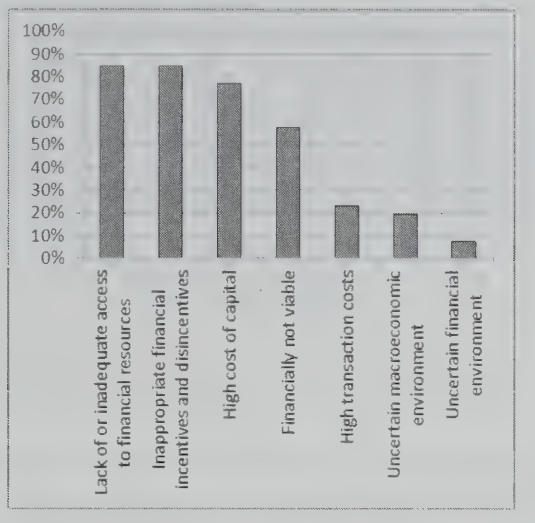
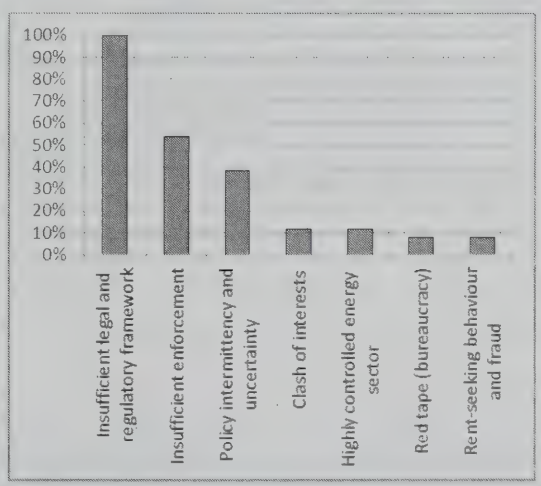



Figure 18

**Policy, legal and regulatory barriers to the development and transfer of mitigation technologies within the energy sector identified in Parties' technology needs assessments (percentage of Parties)**




## 2. Enablers

92. For the energy sector, in order to address the economic and financial barriers identified, the majority of the Parties (83 per cent) mentioned the need to provide or expand financial incentives in relation to the prioritized technology. Other commonly mentioned enablers in this regard were tax exemptions for the imported prioritized technology (56 per cent), the creation of financial products, a mechanism or architecture for the identified technology (44 per cent) and the provision of financial support for the research and development of the technology (32 per cent).

93. To address policy, legal and regulatory barriers within the energy sector, the majority of the Parties (83 per cent) reported the need to formulate detailed regulations and

standards for the new technology. Most of the Parties (56 per cent) also mentioned the need to amend existing laws to consider the new technology.

94. To address technical barriers, many of the Parties (42 per cent) reported the necessity of creating a database or inventory related to the use of the technology. Other technical enablers mentioned were the need to create standards for the technology (38 per cent) and the need to develop and implement a pilot or demonstration project for the prioritized technology (30 per cent).

95. Apart from the measures described above, other measures to address the barriers encountered within the energy sector were the need to facilitate existing or establish new networks of stakeholders (68 per cent of the Parties) and the need to create databases and studies (on the technology and the resources used by the technology, etc.) (40 per cent of the Parties). Examples of specific measures mentioned by Parties as enablers for technologies in the energy sector are presented in box 5.

Box 5
**Examples of specific enablers identified by Parties for mitigation technologies in the energy sector**

| | |
|---|---|
| **Argentina** | Promote synergy between state agencies, research and development institutes and universities |
| **Costa Rica** | Stimulate an education programme on energy efficiency and conservation |
| **Cuba** | Include in national legislation the consideration of environmental externalities |
| **Mali** | Stimulate the use of technology in rural areas |
| **Mauritius** | Allow a two-way flow of electricity between the electricity distribution grid and customers with their own generation |
| **Sri Lanka** | Make underutilized state lands available for technology |
| **Senegal** | Facilitate grid access to third parties |
| **Viet Nam** | Establish a market-driven pricing system for electricity |

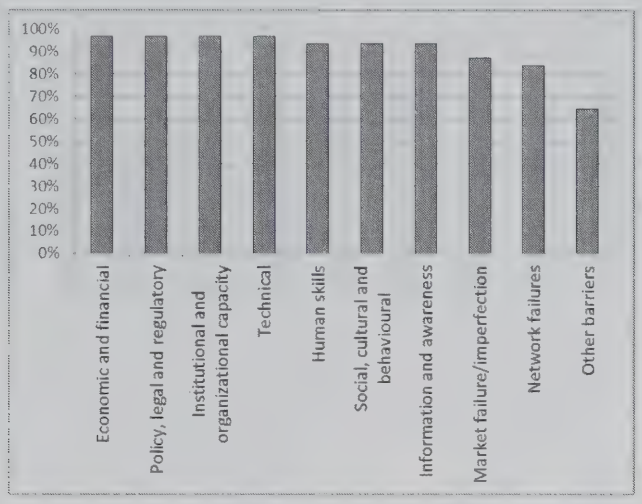
## C. Barriers to and enablers for adaptation technologies

### 1. Barriers

96. For adaptation, irrespective of the sector or technology, almost all of the Parties (97 per cent) identified economic and financial, policy, legal and regulatory, institutional and organizational capacity related, and technical barriers to the development and transfer of their prioritized technologies (see figure 19).

97. Within the category of economic and financial barriers, most of the Parties (90 per cent) identified the lack of or inadequate access to financial resources as the main barrier. For the policy, legal and regulatory barrier category, the most common barrier was an insufficient legal and regulatory framework (85 per cent). For the institutional and organizational barrier category, the most reported barrier was limited institutional capacity (90 per cent), while for the technical barrier category the most commonly reported barrier was system constraints (68 per cent).

Figure 19
**Overview of barriers to technologies for adaptation identified in Parties' technology needs assessments (percentage of Parties)**




### 2. Enablers

98. For adaptation, the most commonly mentioned enabler on a cross-sectoral basis was the measure to increase the financial resources available for the technology, by introducing or increasing the allocation in the national budget or identifying and creating financial schemes, funds, mechanisms or policies. Another commonly mentioned measure was to strengthen the current relevant institutions, via increased human resources and facilities, in order to accelerate the research and development of the technology.

99. Similar to the enablers for mitigation, other commonly mentioned enablers for adaptation on a cross-sectoral basis were the provision of capacity-building and the establishment of information and awareness programmes to promote and develop capacity with regard to the technology.

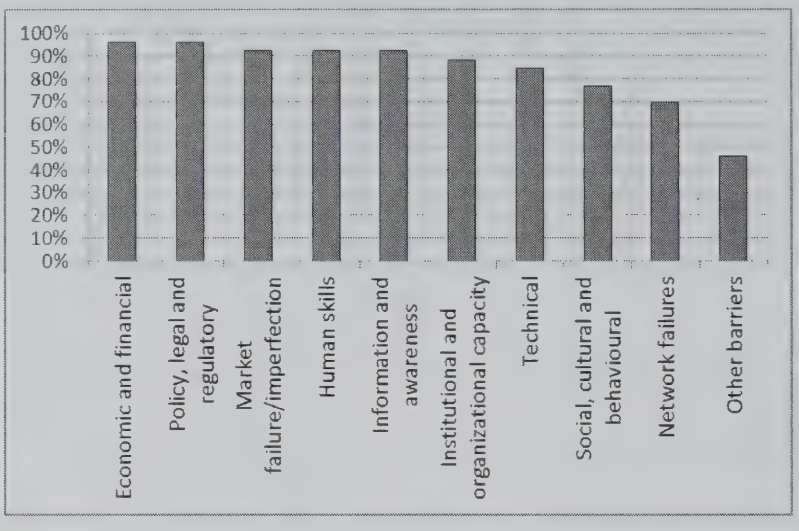
## D. Adaptation: barriers and enablers identified for the agriculture sector

### 1. Barriers

100. For the agriculture sector (the most prioritized adaptation sector), Parties identified potential barriers to the development and transfer of their prioritized technologies spanning the majority of the barrier categories proposed in the UNEP guidebook. The most identified barriers were economic and financial and policy, legal and regulatory (both reported by 96 per cent of the Parties) (see figure 20).

Figure 20

**Overview of barriers to the development and transfer of adaptation technologies within the agriculture sector identified in Parties' technology needs assessments (percentage of Parties)**




101. Within the economic and financial and policy, legal and regulatory barrier categories, the most commonly reported barriers in the agriculture sector were similar to those identified by Parties for the energy sector: a lack of or inadequate access to financial resources for the needed technologies and an insufficient legal and regulatory framework (each reported by almost 90 per cent of the Parties) (see figures 21 and 22).

Figure 21

**Economic and financial barriers to the development and transfer of adaptation technologies within the agriculture sector identified in Parties' technology needs assessments (percentage of Parties)**

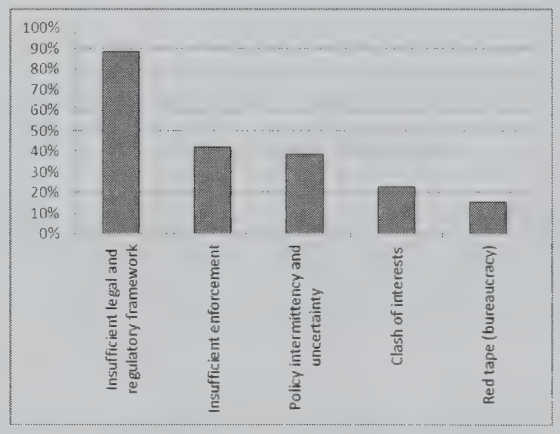
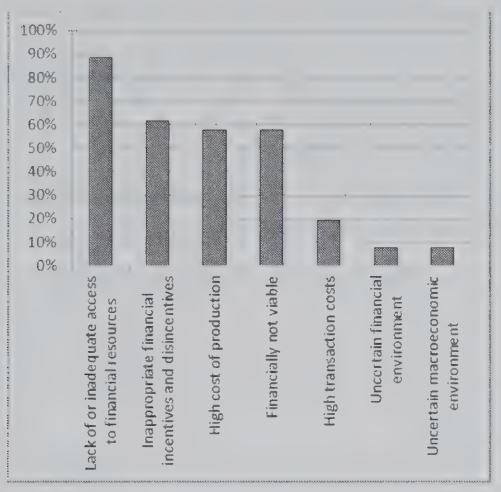


Figure 22
**Policy, legal and regulatory barriers to the development and transfer of adaptation technologies within the agriculture sector identified in Parties' technology needs assessments (percentage of Parties)**




## 2. Enablers

102. To address the identified economic and financial barriers within the agriculture sector, the majority of the Parties (65 per cent) suggested the need to create new financial products, a mechanism or architecture for the prioritized technology. Half of the Parties identified the need to create an allowance in the national budget for the technology (including for research and development activities). Some of the Parties also mentioned the need to review national policies to address price competitiveness in the market (35 per cent of the Parties).

103. The measures put forward to overcome the identified policy, legal and regulatory barriers were quite diverse, including: establishing quality control systems and agriculture crediting and certification systems (27 per cent of the Parties), formulating detailed regulations and standards for the prioritized technology (27 per cent), creating policies to enforce land utilization and avoid conflicts between farmers (23 per cent) and reviewing the current regulatory framework to include an agricultural extension service (educating farmers to apply related scientific research to agricultural practices).

104. In addition to the enablers mentioned above, commonly suggested enablers within the agriculture sector for the other barrier categories included: setting up coordination and communication channels for information exchange between partners (46 per cent of the Parties); increasing research and development programmes (54 per cent); and conducting research and development of the prioritized technology (26 per cent). Some specific enablers mentioned by Parties for adaptation technologies in the agriculture sector are presented in box 6.

Box 6
**Examples of specific enablers identified by Parties for adaptation technologies in the agriculture sector**

| | |
|---|---|
| **Bhutan** | Reinforce the current community-based model and upscale new models for the production of seeds |
| **Cuba** | Implement actions which stimulate an increase in the number of providers of the technology |
| **El Salvador** | Recruit international specialists |
| **Ghana** | Develop a comprehensive action plan for the implementation of the technology in order to support rural communities |
| **Indonesia** | Introduce incentives such as subsidies for fertilizers |
| **Mongolia** | Establish a service for the maintenance of agricultural equipment at the provincial level |
| **Morocco** | Develop a programme for the diffusion of production systems based on direct seeding |
| **Republic of Moldova** | Increase the accountability of farmers for the long-term maintenance of soil quality |

# VI. Technology action plans and project ideas

105. Chapter V above discussed how Parties, in their TNAs, identified existing or potential barriers to the development and transfer of their prioritized technologies. Furthermore, it noted that Parties identified enablers to overcome those barriers.

106. Having identified enablers (measures) to address identified barriers, Parties subsequently further elaborated those measures in TAPs. A TAP is an action plan consisting of a group of measures to address identified barriers to the development and transfer of a prioritized technology. That group of measures (or enabling framework) may include measures at the:

(a) National level (e.g. national emission reduction of 30 per cent by 2020);

(b) Sectoral level (e.g. 30 per cent share of renewable energies in electricity generation by 2030);

(c) Technology-specific level (e.g. research and development of the technology for use in local conditions).

107. Thus, while the TNA technology prioritization process focuses on the benefits and costs of technologies within the national context, the TAPs focus on a group of measures for addressing barriers and accelerating the development and transfer of prioritized technologies.

## A. Actions identified in the technology action plans

108. Over 90 per cent of the Parties prepared TAPs for their prioritized technologies for mitigation and adaptation. In line with the technologies prioritized by Parties, most of the Parties prepared mitigation TAPs for the energy subsectors of energy industries and transport. For adaptation, most of the Parties prepared TAPs for the agriculture and water sectors. Such a profile of TAPs by sector is consistent with the profile of sectors prioritized by Parties in their TNAs.

109. The format of the TAPs and the content of the specific actions varied significantly between Parties. Some of the Parties prepared overarching TAPs at the sectoral level, covering multiple technologies. Other Parties prepared detailed TAPs for a selection of prioritized technologies within a sector. Box 7 provides examples of specific TAPs reported by Parties.

110. However, while there were differences in the format and content of the TAPs, all of the Parties grouped the measures contained in their TAPs into categories similar to those that they used to categorize their barriers. Hence, TAP measures were generally categorized as:

(a) Economic and financial;

(b) Policy, legal and regulatory;

(c) Information and awareness;

(d) Human skills;

(e) Institutional and organizational capacity;

(f) Technical;

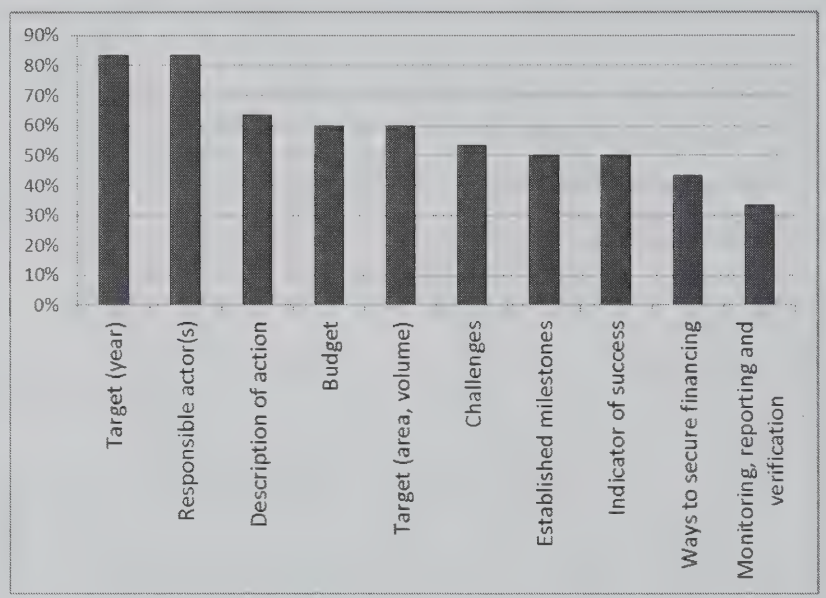
(g) Infrastructure.

Box 7
**Examples of actions identified by Parties in their technology action plans**

| | |
|---|---|
| **Argentina** | Transport in the agriculture sector: technology action plan (TAP) includes 14 measures to address identified barriers and technology needs, the identification of the possible government actors, the time frame and the estimated budget for the group of measures. |
| **Azerbaijan** | TAP for flood warning technology identifies nine measures to address identified technology barriers and includes the identification of, inter alia, measure priorities, justification, time scale, stakeholders, risks, funding sources and estimated costs. |
| **Côte d'Ivoire** | TAP for the diffusion and rapid multiplication of plantain and cassava varieties tolerant to water stress identifies four measures to address financial barriers, technical barriers and barriers related to information sharing and awareness. |
| **Georgia** | TAP for efficient wood stoves includes 17 measures to address identified technology barriers and identifies the priority of the implementation of the measures and other elements such as, inter alia, the implementing agency, time frame and estimated costs for each measure. |
| **Kenya** | TAP for solar dryer technology presents four measures to address identified financial and non-financial barriers, including measures for setting up local assembling industries. |
| **Lebanon** | TAP for combined-cycle gas turbines identifies four measures for the deployment of the technology and includes the identification of priorities, responsible parties, timescale, estimated costs and potential donors. |
| **Rwanda** | TAP for geothermal energy includes nine measures to address financial and non-financial barriers, which are concrete activities, such as the drafting of a law to establish a special fund for subsidies. |

111. With regard to the information contained in the TAPs, most of the Parties (85 per cent) included information about targets and the actors responsible for each of the specified TAP measures. Many of the Parties (60 per cent) also included budget information and description of how a measure should be carried out (see figure 23).

Figure 23
**Frequency of information on measures included in Parties' technology action plans (percentage of the Parties that prepared technology action plans)**




112. Most of the Parties identified TAP measures that were to be implemented within a period of five years, with fewer having a five- to 10-year time frame. Relatively few measures had time frames of between 10 and 20 (or even 30) years, which were generally related to large-scale infrastructural investment or long-term sustainable measures.

113. As part of their TAPs, many of the Parties (75 per cent) prepared technology factsheets. Such factsheets contained information about: the basic characteristics of a prioritized technology; what climate and development benefits it could potentially deliver; and the estimated financing and capacity needs of the TAP. In addition to technology factsheets, around 10 per cent of the Parties also prepared policy factsheets for their TAPs. The policy factsheets contained summaries of the policy-related information included in the TAPs.

114. Most of the Parties elaborated on how they explored the barriers and enabling measures contained in their TAPs. Common methods utilized for that process included: interviews with experts and stakeholders; market mapping and problem trees; dedicated workshops; desk studies; and logical problem analyses.

## B. Estimated budgets identified in the technology action plans

115. Approximately 60 per cent of the Parties provided detailed estimates of the budget required for the actions specified in their TAPs. Most of the Parties specified a budget for each action within their TAPs; however, a few Parties calculated a budget for the overall

TAP only. Additionally, while some of the Parties specified annual costs, most indicated costs for the entire time frame of their TAPs only.[14]

116. For mitigation, the total accumulative estimated budget needed by Parties for their TAPs was USD 5.2 billion. While two Parties reported estimated budgets of greater than USD 1.5 billion, several other Parties reported total budgets that did not exceed USD 10 million. For adaptation, the total estimated accumulative budget requirement of Parties for their TAPs was USD 2.4 billion. Similar to for mitigation, three Parties reported estimated budgets for adaptation of over USD 350 million, while for several other Parties the total budget did not exceed USD 10 million.

117. Although, as noted in paragraphs 115 and 116 above, the budgets of Parties differed significantly in terms of their magnitude and detail, tables 2 and 3 present an overview of the estimated total budget required for TAP actions, specified by action category and time frame.

Table 2
**Specified budgets for the actions contained in Parties' technology action plans in their technology needs assessments for mitigation**

*Mitigation technology action plans with budgets specified by action and time frame (USD million)*

| *Category/time frame* | *< five years* | *Five to 10 years* | *> 10 years* | *Total* |
|---|---|---|---|---|
| Infrastructure | 858 | 2 006 | 1 | 2 865 |
| Economic and financial | 1 167 | 206 | 48 | 1 422 |
| Multiple categories[a] | 286 | 307 | 0 | 593 |
| Institutional and organizational capacity | 73 | 127 | 14 | 214 |
| Policy, legal and regulatory | 33 | 29 | 0 | 62 |
| Research and development | 17 | 18 | 9 | 44 |
| Other | 1 | 6 | 0 | 7 |
| **Total** | **2 435** | **2 700** | **73** | **5 207** |

[a] This refers to Party budgets which were not disaggregated into separate categories.

[14] It should be noted that the budget figures reported by Parties for TAPs are generally the estimated overall budget needed for the implementation of the TAP. The figures may not therefore necessarily reflect the overall net or incremental costs of a project during its lifetime, as they do not include possible project revenues.

Table 3
**Specified budgets for the actions contained in Parties' technology action plans in their technology needs assessments for adaptation**

| *Adaptation technology action plans with budgets specified by action and time frame (USD million)* | | | | |
|---|---|---|---|---|
| *Category/time frame* | *< five years* | *Five to 10 years* | *> 10 years* | *Total* |
| Infrastructure | 615 | 25 | 295 | 934 |
| Economic and financial | 135 | 116 | 615 | 866 |
| Institutional and organizational capacity | 265 | 81 | 23 | 370 |
| Multiple categories[a] | 133 | 17 | 0 | 150 |
| Research and development | 37 | 20 | 3 | 60 |
| Policy, legal and regulatory | 13 | 2 | 13 | 27 |
| **Total** | **1 198** | **261** | **949** | **2 408** |

[a] This refers to Party budgets which were not disaggregated into separate categories.

118. With respect to sectors for mitigation, by far the highest total cumulative TAP budgets were estimated for the energy subsectors of energy industries (USD 4.8 billion; 93 per cent of the total) and transport (USD 187 million). For adaptation, almost the entire estimated budget was for actions in the water and agriculture sectors, USD 1.17 billion (49 per cent) and USD 1.13 billion (43 per cent), respectively.[15]

119. While the budget requirements for TAPs were highly country specific, several of the Parties reported requiring large infrastructure investments to accelerate the development and deployment of large-scale electricity generation technologies. Several other Parties estimated significant government budgets for providing financial incentives, such as subsidies, favourable tax schemes and financial grants.

## C. Project idea reports

120. In addition to preparing TAPs, many of the Parties identified project ideas as the fourth deliverable of their TNAs (see figure 1). In the context of their TNAs, Parties envisaged project ideas as concrete actions for the implementation of their prioritized technologies.

121. Nearly all of the Parties (87 per cent) developed project ideas (concrete proposals or concepts for projects or programmes) as part of the TNA process. The majority of the Parties divided their project ideas fairly evenly between mitigation and adaptation. Similar to the findings in relation to TAPs, the sectoral spread of the project ideas corresponded closely with the sectors prioritized by Parties in their TNAs. Thus, most of the project ideas for mitigation were in the energy subsectors of energy industries and transport and the majority of the project ideas for adaptation were in the agriculture and water sectors.

122. The level of detail of the project idea reports prepared by Parties differed. Some of the Parties elaborated very detailed project ideas, including comprehensive time frames and a breakdown of the estimated budget for the project idea. Others provided a one-page

[15] It should be noted that significant differences in the size of Parties' estimated budgets, as described previously, may affect these conclusions.

factsheet for each project idea with more streamlined information. Irrespective of the overall detail of the information, most of the Parties included sections on the project's objectives, outputs, relation to national development priorities, deliverables, activities, timeline, budget and evaluation methods.

123. Many of the project ideas (46 per cent) consisted of a comprehensive project including elements such as research on the prioritized technology, capacity-building, financial schemes, pilot projects and technology demonstration. A total of 19 per cent of the projects specifically focused on capacity-building and training, while 17 per cent of the project ideas focused solely on research. Box 8 provides examples of project ideas identified by Parties.

Box 8
**Examples of project ideas identified by Parties as part of their technology needs assessments**

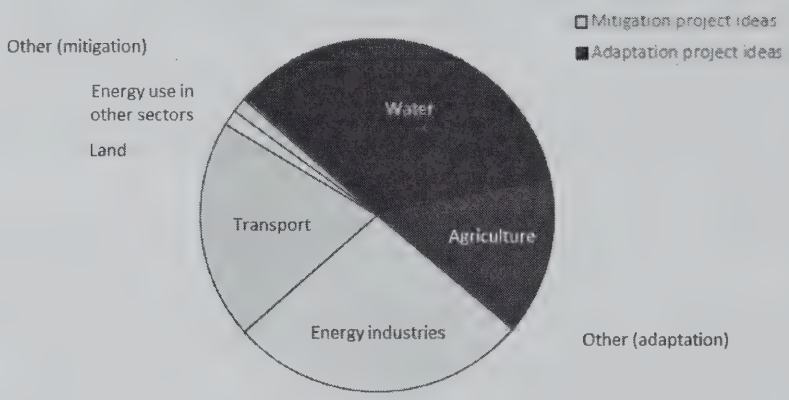
| | |
|---|---|
| **Bangladesh** | Establishment of a special agricultural research and development centre. The project's objective is to develop a research centre which investigates specific climate-resilient crop production technologies. The total estimated budget is USD 6.25 million. |
| **Ghana** | Post-construction support for community-managed water systems. The main components of the project are capacity-building measures and training for a period of five years. Estimated to cost USD 9 million. |
| **Mali** | Dissemination of improved stoves to fight against deforestation is planned for a period of five years or more, with an estimated budget of USD 8.3 million. |
| **Morocco** | Rainwater harvesting project, estimated to cost USD 5.5 million for the period from 2008 to 2030, which includes acquisition, installation, operating, maintenance and renewal fee costs. |
| **Sri Lanka** | Integration of non-motorized transport methods into the regular public transport system. Activities include: infrastructure measures; amendments to the national policies and legislation, and research and development activities. Estimated budget of USD 28.42 million over a three-year timescale. |
| **Zambia** | Conservation farming in combination with agroforestry. The project aims to promote drought-tolerant crop varieties and support the development of integrated farming systems. The preliminary cost for a five year period is estimated at USD 3.3 million. |

124. The estimated accumulative total budget required for the more than 250 project ideas identified by Parties amounted to approximately USD 24.7 billion. However, the estimated national budget differed significantly between different Parties, with the resulting median budget for a project idea equal to USD 2 million.

125. USD 12.5 billion was estimated as the accumulative total budget of project ideas relating to mitigation. While some of the Parties reported estimated budgets of greater than USD 1.1 billion, others reported total budgets that did not exceed USD 10 million. For adaptation, the estimated accumulative total budget for project ideas was USD 12.2

billion.[16] Two Parties reported estimated budgets for adaptation projects of over USD 1.5 billion, while for many others the total budget did not exceed USD 13 million. Figure 24 illustrates the estimated budget for project ideas by mitigation and adaptation sector or subsector.

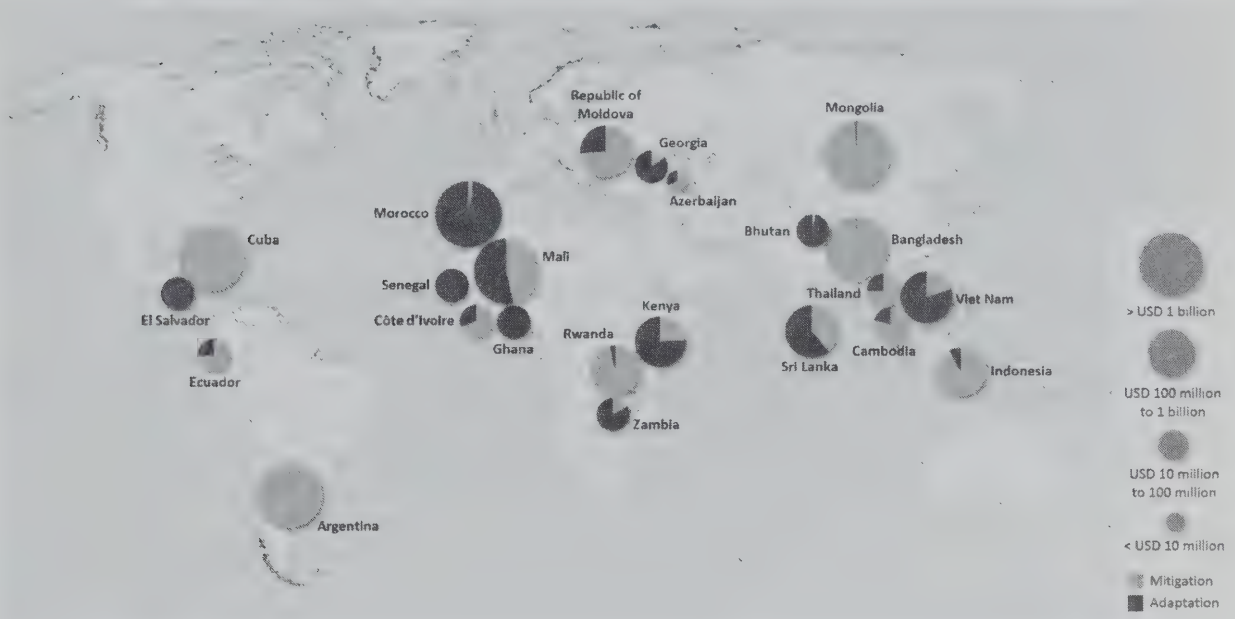
Figure 24
**Budget for project ideas identified by Parties as part of their technology needs assessments by subsector for mitigation and by sector for adaptation**




126. The map shown in figure 25 gives a visual representation of the approximate estimated required budgets for the project ideas of each Party. Argentina, Bangladesh, Cuba, Mali, Mongolia and Morocco each estimated project idea budgets amounting to more than USD 1 billion.

[16] It should be noted that the budget figures reported by Parties for project ideas are generally the estimated overall budget required for the implementation of the project idea. The figures may not therefore necessarily reflect the overall net or incremental costs of a project during its lifetime, as they do not include possible project revenues.

Figure 25
**World map showing Parties' budgets for the project ideas identified as part of their technology needs assessments**




# VII. Cross-cutting elements

127. In the process of compiling and synthesizing the information contained in Parties' TNA reports, many cross-cutting elements and commonalities were discovered between Parties or regions which, although not pertaining directly to the TNA methodology, are important findings related to the TNA process. This chapter explores such elements in four separate sections. The first section synthesizes the information that was reported by Parties on linkages between the TNA process and other processes under and outside of the Convention. The following section synthesizes other cross-cutting information that was reported by various Parties in their TNA reports. In the third section, an analysis of regional differences and similarities is undertaken. Finally, the fourth section compares the findings contained in this report with those in the second synthesis report on technology needs, which was completed in 2009.

## A. Linkages between technology needs assessments and other processes under and outside of the Convention

128. Many of the Parties (over 60 per cent) described possible interlinkages between TNAs and other domestic processes and other processes under the Convention. The majority of those Parties (75 per cent of the Parties that described interlinkages) reported possible interlinkages between TNAs and existing domestic processes related to national sustainable development priorities and goals. Most of them explained how the aforementioned domestic processes were used as inputs to or as a basis for their TNAs.

129. Parties frequently referred to their national communications as important bases and references for the TNA process. Commonly derived from their national communications was information related to: national development priorities; climate change goals; national and sectoral GHG emission profiles; and national vulnerability assessment.

130. Many of the Parties (50 per cent of the Parties that described interlinkages) reported that their TNAs referenced completed work on NAMAs and NAPAs. Some of those Parties (25 per cent) identified outputs from their TNAs that could serve as inputs to their national communications, NAMAs or NAPs. Finally, some of the Parties made clear references to the Technology Mechanism in relation to supporting the implementation of the results of TNAs (see box 9).

131. Although not all of the Parties specified how their TNAs could build upon or provide input to other processes, it is clear that Parties seldom saw the TNA process as a stand-alone process. Instead, TNAs were often seen as complementing national policies and plans for mitigating GHG emissions and adapting to climate change.

Box 9

**Examples of possible interlinkages between technology needs assessments and other processes under and outside of the Convention as reported by Parties in their technology needs assessment reports**

| | |
|---|---|
| **Argentina** | Reported on the possible relevance of the outcomes of its technology needs assessment (TNA) to the formulation of its nationally appropriate mitigation actions (NAMAs) and national adaptation programmes of action (NAPAs). It also underscored the potential supporting role of the Technology Executive Committee and the Climate Technology Centre and Network (CTCN) in promoting the development of environmentally friendly technologies. |
| **Bangladesh** | Noted that TNAs play two important roles within the country. Firstly, TNAs support the formulation of domestic development strategies. Secondly, TNAs help identify NAMAs. In addition, the TNA for adaptation is a prerequisite for implementing climate-resilient development planning with innovative adaptive measures (through the introduction of new and appropriate technologies). |
| **Dominican Republic** | Reported that the TNA project is related to two important pillars of the country's climate-compatible national development: (a) the National Development Strategy and Economic Development Plan; and (b) the process of identifying NAMAs. |
| **Georgia** | Suggested that a clear link should be established between the outcomes of the TNA process and the work of the CTCN. It recommended the joint undertaking of feasibility studies and the exchanging of experiences and software used for the TNAs. Such knowledge and experience could be provided by the CTCN to support the establishment and strengthening of local capacities. |
| **Mauritius** | Envisaged that the leaning-by-doing methodology in the TNA project could be used for developing NAMAs. In addition, the programmatic approach used for the national TNA is aligned with the development of sectoral NAMAs. |
| **Peru** | Noted that the results of its TNA project could provide input to the NAMAs that will be formulated to help achieve national voluntary greenhouse gas emission reduction targets. |
| **Sudan** | Prepared a NAPA in 2007 highlighting the key adaptation activities in agriculture. The resulting framework for enabling actions served as input to its adaptation TNA. |
| **Zambia** | Utilized existing national development plans and climate-related documents (such as its second national communication, National Climate Change Response Strategy and a NAPA) as relevant documents for its TNA. |

## B. Other elements of the technology needs assessment process

132. In compiling and synthesizing the information contained in Parties' TNA reports, it was noted that there is not always a clear boundary between the extent of the TAPs and that of the project ideas. In general, Parties developed TAPs consisting of a group of measures to address identified barriers to the development and transfer of a prioritized technology. In contrast, the project ideas were envisaged by Parties as concrete actions for the implementation of a prioritized technology. However, in some TAPs pilot projects were included, and various project ideas also focused on addressing more specific identified barriers to the development and transfer of technology.

133. Some of the Parties, in their TNA reports, referred to issues related to intellectual property rights (IPRs). Such issues were mainly raised in relation to economic and financial barriers, in particular regarding the cost implications of obtaining access to certain technologies, and policy, legal and regulatory barriers, in particular regarding the protection of IPRs in the recipient country. Some of the Parties identified the lack of experts in negotiating IPR contracts as a barrier to the transfer and diffusion of their prioritized technologies. The majority of those Parties identified the need for international cooperation to gain more clarity on the role that IPRs play in technology development and transfer.

## C. Regional analysis

134. With regard to the results of the TNAs, the analysis of the TNA reports revealed that there are differences between regions across almost all of the steps in the TNA process.

### 1. The technology needs assessment process

135. With regard to stakeholder involvement, NGOs were reported to be involved in the TNA processes of most Asia-Pacific Parties (72 per cent of the Parties from that region), most African Parties (95 per cent) and all of the Eastern European Parties. However, only some of the Latin America and Caribbean Parties (25 per cent) involved NGOs in the TNA process. Also, many of the Asia-Pacific Parties (56 per cent) involved international experts, while only one Party outside of that region did so.

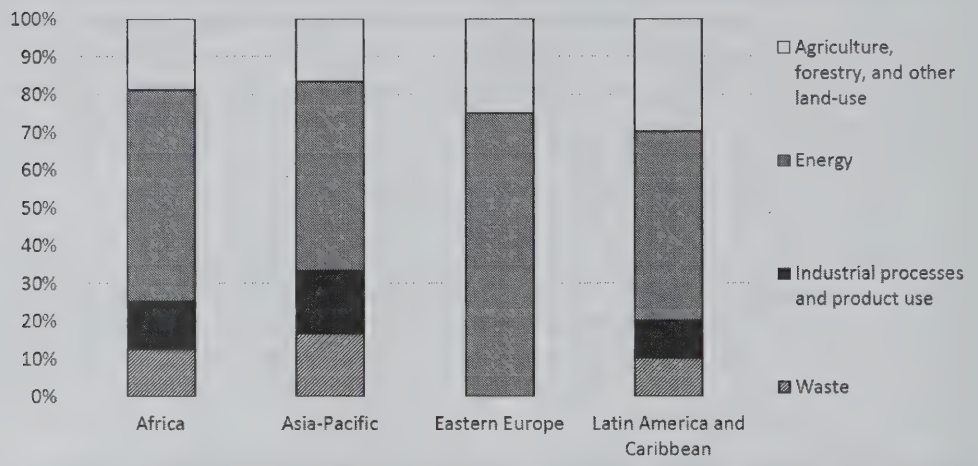
136. With regard to national development priorities, while all of the Eastern European Parties and many of the Latin America and Caribbean (63 per cent) and Asia-Pacific (40 per cent) Parties reported the reduction of air, soil and water pollution as national development priorities, only a small number of the African Parties (10 per cent) reported the same priorities. For the African Parties, the most identified environmental development priority was environmentally sustainable development.

137. Energy security was identified as a priority by all of the Eastern European Parties and many of the Asia-Pacific (60 per cent) and African (30 per cent) Parties. For Latin America and Caribbean Parties, however, only 13 per cent selected that development priority. Food security was also an important issue for most of the regions, being identified by many of the Eastern European (67 per cent), African (50 per cent) and Asia-Pacific (30 per cent) Parties.

### 2. Prioritized sectors

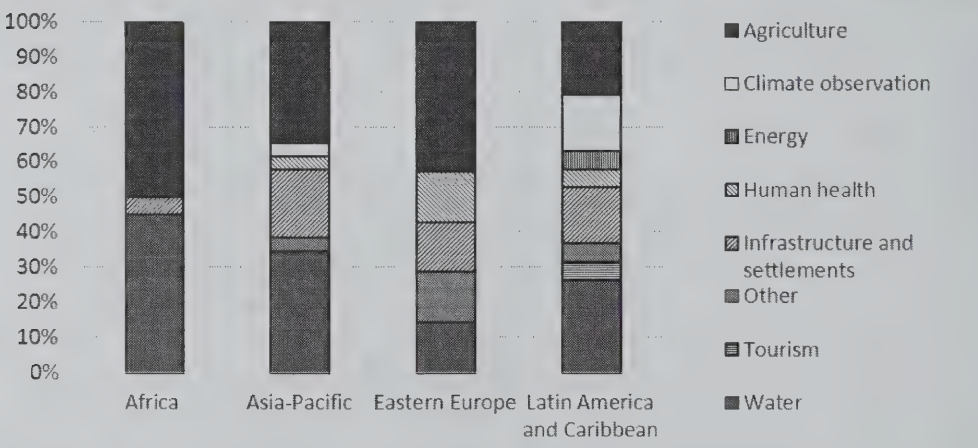
138. In all regions, the energy sector was the most prioritized mitigation sector by Parties. African, Asia-Pacific and Latin America and Caribbean Parties also prioritized the waste, agriculture, forestry and other land-use, and industrial processes and product-use sectors, while Eastern European Parties focused their TNAs on the energy and agriculture, forestry and other land-use sectors (see figure 26).

Figure 26
**Prioritized mitigation sectors in technology needs assessments by region (percentage of all prioritized sectors in the region)**




139. For adaptation, in all regions the agriculture and water sectors were the most prioritized; however, there were significant regional differences. For African Parties those sectors combined amounted to 95 per cent of the prioritized sectors, while for Latin America and Caribbean Parties only 47 per cent of the prioritized sectors were either agriculture or water (see figure 27).

Figure 27
**Prioritized adaptation sectors in technology needs assessments by region (percentage of all prioritized sectors in the region)**




### 3. Prioritized technologies

140. For mitigation, many of the African and Latin America and Caribbean Parties (both more than 40 per cent) prioritized technologies relating to the use of biomass. There was relatively little prioritization of that technology by the Asia-Pacific and Eastern European Parties. While wind turbines were a commonly prioritized technology by the African Parties (40 per cent), only a small number of the Asia-Pacific and Eastern European Parties prioritized that technology.

141. Technologies related to solar power were prioritized by almost all of the African Parties (90 per cent). Many of the Eastern European Parties (67 per cent) prioritized solar thermal systems (e.g. for water heating). Only some of the Asia-Pacific Parties (22 per cent) prioritized solar technologies.

142. With regard to adaptation, technologies for the development of new crop varieties, such as drought-resistant and salinity-resistant varieties, were prioritized by many of the African and Asia-Pacific Parties (60 per cent each). However, only a few of the Eastern European (33 per cent) and Latin America and Caribbean (13 per cent) Parties prioritized that technology. Many of the African Parties (45 per cent) prioritized conservation agriculture, while only a small number of the Eastern European (33 per cent) and Asia-Pacific (10 per cent) Parties prioritized that technology.

### 4. Barriers to technology transfer

143. Table 4 provides an overview of the most commonly reported barriers to mitigation technology by region. It can be observed that, while there are many barriers that are common across regions, there are also some barriers that are specific to certain regions. Barriers such as inappropriate financial incentives and disincentives, an insufficient legal and regulatory framework and a poor market infrastructure were commonly reported by Parties from three of the four regions. On the other hand, only the Latin America and Caribbean Parties commonly reported the barrier of weak connectivity between actors favouring the new technology.

Table 4
**Commonly reported barriers to the development and transfer of mitigation technologies by region**

| *Africa* | *Asia-Pacific* |
|---|---|
| • Inappropriate financial incentives and disincentives | • Lack of or inadequate access to financial resources |
| • Insufficient legal and regulatory framework | • High cost of capital |
| • Poor market infrastructure | • Insufficient legal and regulatory framework |
| • Inadequate information | • Poor market infrastructure |
| | • Lack of skilled personnel for the installation and operation of climate technologies |
| *Eastern Europe* | *Latin America and Caribbean* |
| • Inappropriate financial incentives and disincentives | • Inappropriate financial incentives and disincentives |
| • Lack of or inadequate access to financial resources | • Weak connectivity between actors favouring the new technology |
| • High cost of capital | • Limited institutional capacity |
| • Insufficient legal and regulatory framework | • Lack of skilled personnel for the installation and operation of climate technologies |
| • Poor market infrastructure | • Inadequate information |

144. For adaptation, a lack of or inadequate access to financial resources and inadequate information were barriers commonly reported by Parties from three of the four regions. On the other hand, only the Latin America and Caribbean Parties commonly reported barriers related to traditions and habits. Similarly, only the Eastern European Parties commonly

identified barriers related to the high cost of production of the prioritized technology and the financial viability of the technology (see table 5).

Table 5
**Commonly reported barriers to the development and transfer of adaptation technologies by region**

| *Africa* | *Asia-Pacific* |
|---|---|
| • Lack of or inadequate access to financial resources<br>• Poor market infrastructure<br>• Restricted access to technology<br>• Limited institutional capacity<br>• Inadequate information | • Lack of or inadequate access to financial resources<br>• Limited institutional capacity<br>• Inadequate information |
| *Eastern Europe* | *Latin America and Caribbean* |
| • High cost of production<br>• Financially not viable<br>• Restricted access to technology<br>• Insufficient legal and regulatory framework<br>• Inadequate information | • Lack of or inadequate access to financial resources<br>• Insufficient legal and regulatory framework<br>• Traditions and habits<br>• Inadequate information |

## D. Comparison of the findings contained in the second and third synthesis reports on technology needs

145. By comparing the findings contained in the second and third synthesis reports on technology needs, it was found that, from the TNA reports of Parties participating in the global TNA project (which were synthesized in the third synthesis report):

(a) Stakeholders have been more involved throughout the entire TNA process. According to this report, Parties reported that stakeholders were involved throughout the entire TNA process, while the second synthesis report found that Parties reported that stakeholders were less involved in certain stages of the TNA process, such as in the prioritization of technology needs, the identification of project ideas and the identification of next steps. According to both reports Parties reported that representatives of the finance community were not frequently involved in the TNA process;

(b) More Parties have stated their national development priorities as a starting point for their TNA processes. According to this report, most of the Parties (more than 81 per cent) stated their national development priorities and used them as a basis for prioritizing sectors. According to the second synthesis report most of the Parties did not state their national development priorities and only some of the Parties (about 10 per cent) stressed the importance of integrating climate change mitigation and adaptation measures into their national development priorities;

(c) The prioritization of mitigation sectors has remained the same. This report states that the energy sector was the most prioritized mitigation sector, followed by the agriculture, forestry and other land-use sector and the waste sector. The most commonly identified mitigation sectors according to the second synthesis report were: energy; agriculture, land use and forestry; waste management; and industry;

(d) The prioritization of adaptation sectors has remained the same. This report states that the most commonly prioritized sectors for adaptation were agriculture, water and infrastructure and settlements (including coastal zones). According to the second synthesis report most of the Parties identified agriculture and forestry, coastal zones and water resources as the priority sectors for adaptation;

(e) The prioritization of mitigation technologies has changed significantly. For the energy sector (the most prioritized mitigation sector according to both the second and third synthesis reports), according to this report the most prioritized mitigation technologies for the energy industries subsector were solar photovoltaic, followed by biomass/biogas, efficient lighting, waste to energy, wind turbines, hydropower and combined heat and power. In the second synthesis report the most commonly prioritized mitigation technologies in the energy sector were listed as renewable energy technologies, energy efficiency and conservation, fossil energy supply and combined heat and power;

(f) The prioritization of technologies for adaptation has changed significantly. For the agriculture sector (the most prioritized adaptation sector according to both the second and third synthesis reports), according to this report the technologies most commonly prioritized by Parties were biotechnologies, improved agricultural practices (including irrigation) and conservation agriculture. According to the second synthesis report crop management, land management, forestry and irrigation were the most prioritized technologies for the agriculture sector;

(g) The barriers to the development and transfer of prioritized technologies have changed marginally. In this report the most frequently identified mitigation barriers are reported as economic and financial barriers and technical barriers, followed by policy, legal and regulatory barriers and information- and awareness barriers. The most frequently identified adaptation barriers are reported as economic and financial barriers, policy, legal and regulatory barriers, the lack of institutional and organizational capacity and technical barriers. In the second synthesis report the most frequently identified barriers to both mitigation and adaptation were reported as economic and market barriers, followed by barriers relating to human capacity, and information- and awareness barriers;

(h) The enablers identified by Parties to overcome the barriers to the development and transfer of their prioritized technologies have changed marginally. In this report the most commonly identified enablers to overcome identified barriers related to mitigation technologies reported include: the provision or expansion of financial incentives for the implementation and use of the related technology; and the formulation or updating of regulations, policies and standards related to the technology. The most commonly identified adaptation-related enablers reported include increasing the financial resources available for the technology and the strengthening of current relevant institutions with increased human resources and facilities. In the second synthesis report reported identified enablers to address barriers to technology transfer included: improving the economic situation; gaining access to funds and funding sources; taking market stabilization measures; and rationalizing prices and removing unreasonable subsidies;

(i) Parties have prepared comprehensive TAPs as part of the TNA process. In the TNA reports synthesized as part of this report, most of the Parties reported comprehensive TAPs aimed at addressing the barriers to the development and transfer of their prioritized technologies. In the TNA reports synthesized for the second synthesis report, Parties only elaborated on the identification of possible next steps to address the identified barriers;

(j) More Parties have prepared project ideas with concrete actions for the implementation of their prioritized technology needs. This report has shown that almost all of the Parties (more than 85 per cent) developed project ideas based on their prioritized

technology needs, while according to the second synthesis report only some of the Parties (35 per cent) prepared project ideas;

(k) Parties have prepared more project ideas on technologies for adaptation. This report has shown that most of the Parties (more than 80 per cent) identified project ideas for technologies for adaptation to climate change. That is a significant shift towards adaptation-related project ideas, as the second synthesis report reported that only some of the Parties (about 20 per cent) identified project ideas for technologies for adaptation to climate change.

# VIII. Key findings

146. **One of the overarching key findings** arising from this report is that the TNAs conducted by Parties led to the **development of national TAPs** that recommended enabling frameworks to address identified barriers to the diffusion of prioritized technologies. Those TAPs and, additionally, the project ideas prepared by Parties facilitated the identification of technology transfer projects and their links to financing sources.

147. Of the 31 Parties that participated in the global TNA project, **29 prepared TNA reports on mitigation and all of them prepared TNA reports on adaptation.** Almost all of the Parties prepared detailed TNA reports covering the full TNA process as suggested in the guidance provided by UNEP and in the TNA handbook. The TNA reports often included separate reports for each step of the TNA process, including TNA, barrier analysis and enabling framework, TAP and project ideas reports.

148. Most of the Parties (77 per cent) reported that the coordination of the TNA process was carried out by a **national ministry and all of the Parties mentioned involving stakeholders** in the TNA process.

149. Commonly identified stakeholders were national government representatives, the academic sector, the private sector, independent consultants and NGOs. However, only a small number of the Parties (fewer than 15 per cent) reported involving stakeholders **from the finance community**.

150. Most of the Parties (81 per cent) stated **their national development priorities as a starting point for their TNA processes**. Nearly all of the Parties provided information on their **national circumstances** with regard to the mitigation of GHG emissions and adaptation to climate change. That information, combined with their national development priorities, including existing policies and measures, was then used as a basis for the prioritization of sectors for the TNA.

151. For mitigation, most of the Parties prioritized sectors and subsectors taking into consideration the **GHG emissions from the primary national sectors and the development priorities of the country**. For adaptation, the majority of the Parties prioritized adaptation sectors taking into consideration the sectors' **vulnerability reduction potential and their national development priorities**.

152. **For mitigation, the most prioritized sector was the energy sector** (prioritized by 90 per cent of the Parties). The prioritized subsectors of the energy sector were energy industries (82 per cent of the Parties) and transport (41 per cent). **For adaptation, the agriculture (84 per cent) and water (77 per cent) sectors were the most prioritized by Parties**.

153. Following the prioritization of sectors for their TNAs, all of the Parties prioritized technologies in those sectors using specific criteria. For **prioritizing mitigation technologies**, most of the Parties applied social (97 per cent of the Parties), economic (86

per cent) and environmental (79 per cent) criteria, as well as the potential of the technology to reduce GHG emissions (97 per cent), its market potential (72 per cent), its employment generation potential (55 per cent) and its investment and operational costs (55 and 52 per cent, respectively).

154. For prioritizing **technologies for adaptation**, Parties applied social (90 per cent of the Parties), environmental (90 per cent) and economic (81 per cent) criteria, as well as the potential contribution of the technology to the reduction of the national vulnerability to climate change (94 per cent) and the technology's investment and operational costs (65 and 42 per cent, respectively).

155. Within the energy sector (the most prioritized mitigation sector), the majority of the **technologies prioritized for the energy industries subsector** were related to electricity generation. Solar photovoltaic and biomass/biogas electricity generation technologies were the most prioritized technologies (by almost 40 per cent of the Parties), followed by efficient lighting, waste to energy, wind turbines, hydropower and energy efficiency for electricity generation.

156. The **technology needs identified in relation to adaptation** comprised hard technologies, such as dikes and floodwalls, community irrigation systems and salinity-tolerant rice varieties, and soft technologies, such as the organization of water user associations and knowledge transfer.

157. Within the agriculture sector (the most prioritized adaptation sector), **the majority of the adaptation technologies prioritized were related to crop management**. Biotechnologies, including technologies related to crop improvements, new varieties and drought-resistant, salient-tolerant and short-maturing varieties, were the most prioritized technologies (prioritized by more than 50 per cent of all of the Parties that prepared TNAs for adaptation), followed by improved agricultural practices (including irrigation), conservation agriculture, agroforestry and soil and nutrient management.

158. Following the prioritization of technologies, most of the Parties undertook an analysis of technology-specific barriers to the development and transfer of their prioritized technologies, followed by the identification of the measures required to overcome such barriers.

159. **The most commonly reported barriers to the development and transfer of prioritized mitigation technologies were economic and financial and technical barriers**. Within the first category (economic and financial), most of the Parties (90 per cent) identified inappropriate financial incentives and disincentives as the main barrier. In the technical barrier category, many of the Parties (69 per cent) identified system constraints and inadequate standards, codes and certification as the main barriers.

160. **For mitigation, the most commonly mentioned enabler on a cross-sectoral basis** was the measure to provide or expand financial incentives for the implementation and use of the related technology. Another commonly mentioned measure was the formulation or updating of regulations, policies and standards related to the technology.

161. **For adaptation, almost all of the Parties (97 per cent) identified the following barriers** to the development and transfer of their prioritized technologies**: economic and financial; policy, legal and regulatory; institutional and organizational capacity; and technical**.

162. For adaptation, within the category of economic and financial barriers, most of the Parties (90 per cent) identified the lack of or inadequate access to financial resources as the main barrier. In the policy, legal and regulatory barrier category, the most common barrier identified was an insufficient legal and regulatory framework (85 per cent). In the institutional and organizational barrier category, the most commonly reported barrier was

limited institutional capacity (90 per cent), while in the technical barrier category the most commonly reported barrier was system constraints (68 per cent).

163. **For adaptation, the most commonly mentioned enabler on a cross-sectoral basis** was the measure to increase the financial resources available for the technology, by introducing or increasing the allocation for that technology in the national budget or by identifying and creating financial schemes, funds, mechanisms or policies.

164. **Over 90 per cent of the Parties developed TAPs**, which consisted of a group of measures to address identified barriers to the development and transfer of a prioritized technology. Most of the Parties (more than 85 per cent) included in their TAPs information on targets, budget and the actors responsible for the actions. Less frequently included in TAPs were information about ways to secure funds (around 45 per cent of the Parties) and monitoring, reporting and verification requirements (around one third of the TNAs).

165. Over 60 per cent of the Parties specified costs for the implementation of their TAPs, with the **sum totalling USD 5.2 billion for mitigation and USD 2.4 billion for adaptation**. However, the size of Parties' budgets varied significantly.

166. **Nearly all of the Parties (87 per cent) developed project ideas as part of their TNA processes**. In the context of their TNAs, Parties envisaged project ideas as concrete actions for the implementation of a prioritized technology. Parties prepared project ideas at different levels of detail. Many of the project ideas (46 per cent) foresee a project that consists of a comprehensive programme, including research, capacity-building, financial schemes, pilot projects and demonstrations. **USD 12.5 billion was estimated by Parties to be required for project ideas related to mitigation and USD 12.2 billion for adaptation projects**. However, as for the TAPs, the size of the individual budgets varied significantly between Parties.

167. **Parties seldom saw the TNA process as a stand-alone process**. Rather, TNAs were often seen as complementing national policies and plans for mitigating GHG emissions and adapting to climate change.

168. **Over half of the Parties** (60 per cent) **elaborated on possible interlinkages between TNAs and other climate- and development-related domestic processes or other processes under the Convention**. Approximately half of those Parties noted that their TNAs referenced completed work on NAMAs and NAPAs, or **identified the outputs of their TNAs as inputs to work on their national communications, NAMAs or NAPs**. A few of the Parties made clear references to the Technology Mechanism in relation to supporting the implementation of the results of TNAs.

169. A comparison of the findings contained in the second and third synthesis reports on technology needs revealed that there are differences between the findings. The **most significant differences were found in the areas of stakeholder involvement, national development priorities**, technology prioritization for adaptation, technology action plans and project ideas. Commonalities were found in relation to the prioritization of sectors for mitigation and adaptation, the prioritization of technologies for mitigation, and barriers to and enablers for the development and transfer of mitigation and adaptation technologies.

# Annex I

## List of the technology needs assessment reports included in the compilation and synthesis for the third synthesis report on technology needs identified by Parties not included in Annex I to the Convention

Table 6
**List of the technology needs assessment reports included in the compilation and synthesis for the third synthesis report on technology needs identified by Parties not included in Annex I to the Convention**

| *No.* | *Party* | *Region* | *Language* | *Mitigation report* | *Adaptation report* |
|---|---|---|---|---|---|
| 1 | Argentina | Latin America and Caribbean | Spanish | Yes | Yes |
| 2 | Azerbaijan | Eastern Europe | English | Yes | Yes |
| 3 | Bangladesh | Asia-Pacific | English | Yes | Yes |
| 4 | Bhutan | Asia-Pacific | English | Yes | Yes |
| 5 | Cambodia | Asia-Pacific | English | Yes | Yes |
| 6 | Colombia | Latin America and Caribbean | Spanish | Yes | Yes |
| 7 | Costa Rica | Latin America and Caribbean | Spanish | Yes | Yes |
| 8 | Côte d'Ivoire | Africa | French | Yes | Yes |
| 9 | Cuba | Latin America and Caribbean | Spanish | Yes | Yes |
| 10 | Dominican Republic | Latin America and Caribbean | Spanish | Yes | Yes |
| 11 | Ecuador | Latin America and Caribbean | Spanish | Yes | Yes |
| 12 | El Salvador | Latin America and Caribbean | Spanish | No | Yes |
| 13 | Georgia | Eastern Europe | English | Yes | Yes |
| 14 | Ghana | Africa | English | No | Yes |
| 15 | Indonesia | Asia-Pacific | English | Yes | Yes |
| 16 | Kenya | Africa | English | Yes | Yes |
| 17 | Lao People's Democratic Republic | Asia-Pacific | English | Yes | Yes |
| 18 | Lebanon | Asia-Pacific | English | Yes | Yes |
| 19 | Mali | Africa | French | Yes | Yes |
| 20 | Mauritius | Africa | English | Yes | Yes |
| 21 | Mongolia | Asia-Pacific | English | Yes | Yes |
| 22 | Morocco | Africa | French | Yes | Yes |
| 23 | Peru | Latin America and Caribbean | Spanish | Yes | Yes |
| 24 | Republic of Moldova | Eastern Europe | English | Yes | Yes |

| *No.* | *Party* | *Region* | *Language* | *Mitigation report* | *Adaptation report* |
|---|---|---|---|---|---|
| 25 | Rwanda | Africa | English | Yes | Yes |
| 26 | Senegal | Africa | French | Yes | Yes |
| 27 | Sri Lanka | Asia-Pacific | English | Yes | Yes |
| 28 | Sudan | Africa | English | Yes | Yes |
| 29 | Thailand | Asia-Pacific | English | Yes | Yes |
| 30 | Viet Nam | Asia-Pacific | English | Yes | Yes |
| 31 | Zambia | Africa | English | Yes | Yes |

# Annex II

## Sectors prioritized by each Party in their technology needs assessments

Figure 28

**Prioritized sectors for mitigation identified in technology needs assessments by Party (as a percentage of the total number of sectors that the Party prioritized)**

Figure 29

**Prioritized sectors for adaptation identified in technology needs assessments by Party (as a percentage of the total number of sectors that the Party prioritized)**